SYSTEMS.INC.

DUAL SETPOINT PROGRAMMER

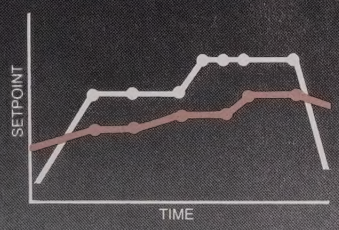
Here is a complete, all-digital dual setpoint programming system that brings all setpoint controls for two control loops under a single, self-contained unit. The Model 240 can produce setpoint profiles for direct digital control of JC Systems digital process controllers, or for a wide variety of analog controllers.

The Model 240 can operate alone, or with full computer communications via IEEE-488 or RS-232C/RS-422A interfaces.

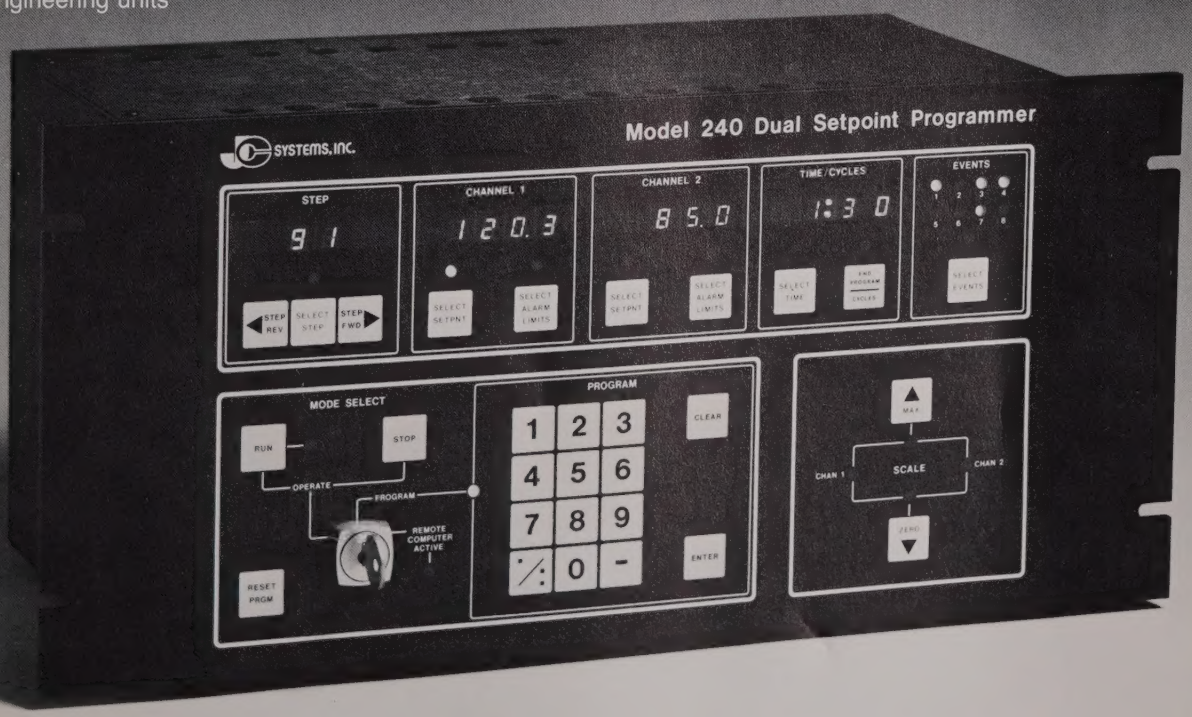
By far the easiest setpoint programmer to learn to use, the JC Systems Model 240 makes the job of preparing temperature, pressure, humidity and other profiles a lot simpler and a lot less costly.

MODEL 240

- Direct digital setpoint control
- Easy to program and use
- 91 ramp or soak segments
- Four continuous parameter displays
- Readouts directly in engineering units



- Non-volatile program memory
- Deviation alarms settable for each segment
- Eight programmable on/off event outputs
- Guaranteed soak capability
- Computer compatible— RS-232C/RS-422A or IEEE-488
- Two ranges: ±999.9 (degrees or units) or ±9999 (degrees or units)



The JC Systems Model 240 Dual Setpoint Programmer is a complete system for controlling the setpoints of two control loops over varying time periods. It allows you to prepare setpoint profiles of temperature, pressure, humdity or other process variables with very simple or very complex requirements.

CONTROLLER TYPES

The Model 240 provides Direct Digital Control (DDC) of one or two JC Systems Digital Process Controllers. These controllers have three-mode PID control, dual outputs, and direct digital settings for gain, reset, rate, reset windup inhibit and proportioning period. When equipped with an optional digital to analog converter, the Model 240 can also operate with other analog or digital controllers that have a remote setpoint input.

SETPOINT PROFILES

Up to 91 segments are available, each one a ramp or soak segment. The 91 segments may be divided up into any number of programs, and any program may be automatically repeated up to 9998 times. Segment times are entered in hours and minutes, up to 99 hours, 59 minutes per segment.

Ramp segments are formed by entering the ending setpoint and the time duration. The Model 240 produces a linear setpoint change from the previous setpoint to the new one over the specified time interval. To assure no system shocks, the first segment of a program begins automatically from the current process temperature (or other process variable).

Each of the dual setpoints is individually settable for each segment, via simple keyboard entry of the desired setpoint. Entries and displays are directly in temperature or humidity, or can be scaled by front panel entry to any linear engineering units—such as pressure, flow, altitude, level, etc., when used with the optional D to A converter.

EASY, SAFE FRONT PANEL KEYBOARD

All entries are made via the sealed, wide area keyboard. During operation, four numeric LED displays show the segment number, the two setpoints or alarm limits, and the time remaining in the segment. During programming, the displays confirm keyboard entries. LED indicators show the condition of the eight on/off event outputs, as well as alarm status on the two setpoint channels. A locking keyswitch selects programming mode, local operation, or remote computer control.

DEVIATION LIMITS, ALARMS, AND GUARANTEED SOAK

For each segment, deviation limits may be set, which provide for a flashing display lamp and an alarm output signal if the deviation limit has been exceeded. The deviation alarm condition may also be used to "freeze" the segment clock temporarily until manually reset, or until the process variable returns to within the deviation band established. All deviation limits are "tracking", in that they follow the setpoint value while ramping.

In addition to these features, a guaranteed soak operation is available, which inhibits the advance from one segment to the next until the process reaches within $\pm 0.4°$ or $1.6°$ (or units) of the desired setpoint.

(Deviation limits, alarms, and guaranteed soak are available only when used with JCS Digital Process Controllers, or other controllers with a Process Variable output of 0-5V, matching the setpoint input.)

SCALING

Scaling to engineering units is automatically done by the controller when JC Systems Digital Process Controllers are being used.

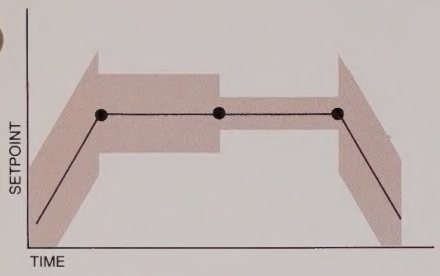
When other controllers are employed, optional DC Analog Output modules are added to the system which provide outputs to the controller's remote setpoint input. To scale these signals, the Model 240 allows the 0 and 5V points to be assigned any signed 4-digit numbers. Scaling factors are entered directly from the keyboard, and remain in effect until changed. Values are then entered directly in engineering units.

COMPUTER CONTROL

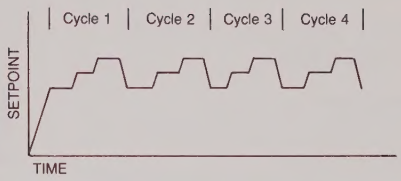
The Model 240 offers serial computer communications via a built-in serial interface operating at 300 baud. Optionally, the serial computer communications may be expanded to provide RS-422A party line multidrop applications at rates up to 4800 baud.

The IEEE-488 Interface option allows full computer interrogation of process variables, setpoints, time in segment, scaling values and alarm status as well as program start/stop, saving and downloading. Alarms and/or external inputs may generate a Serial Poll Request as an interrupt.

The Serial Interface has all the features of the IEEE-488 interface, except for serial poll capability. If the RS-422A option is installed, party line operation allows up to 50 Model 240s to be addressed.



Deviation alarms *can be set to different levels during every segment of the profile. (Available when using JCS Digital Process Controllers or analog controllers with process variable output signals.)*



Program repetition *of up to 9999 cycles simplifies the setup procedure and conserves programming memory.*

STOP *freezes the setpoint and segment clock for program review or controller tuning.*

Review any segment *of any program during Program or Stop modes.*

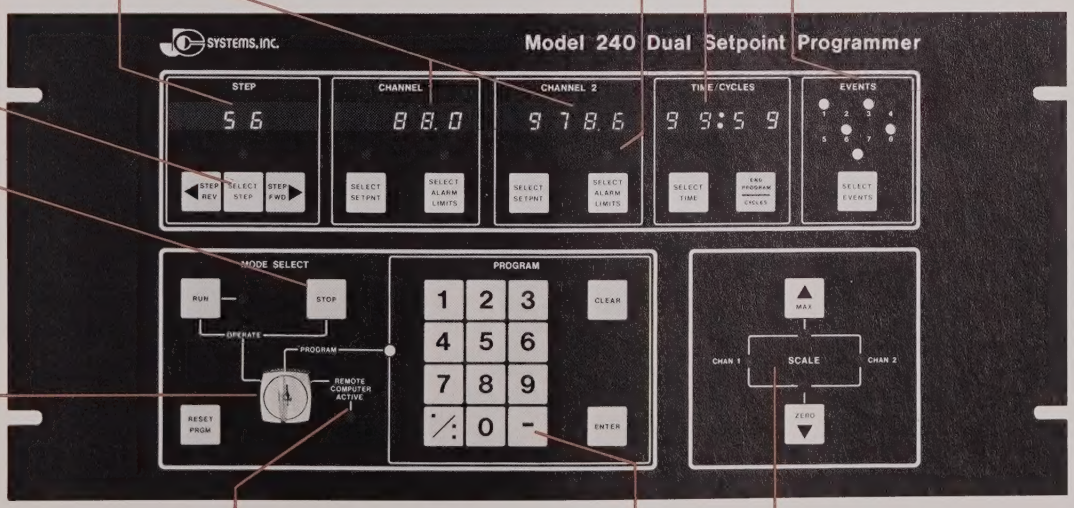
Current step (segment) number *is displayed during operation. During programming or STOP modes, any step may be selected for viewing.*

Four-digit LED displays *continuously display both current setpoints during operation. Deviation limits and scaling are also set using these displays.*

Deviation alarm *conditions are indicated by these LEDs, as well as signal outputs, messages to the computer, and program halting if desired.*

Time remaining in segment *is continuously displayed here. The cycle number (in repeat mode) may also be reviewed.*

Eight event outputs *are each individually controlled for off/on operation during each segment. They're ideal for control of annunciators, gas sequencers, interlocks, or other external devices.*



Computer communications *include downloading or uploading of programs, plus reporting of Process Variable, Setpoint, alarm status, time in segment, etc.*

Scaling *for process variables is a snap—you may convert a 0-100% process reading to any 4-digit signed numbers. Program in actual values after system has been scaled.*

Locking keyswitch *limits programming entries to authorized personnel.*

Large, dustproof keypad *is used for direct entry of setpoints, alarms, events, scaling and other data.*

SPECIFICATIONS

MODEL 240 DUAL SETPOINT PROGRAMMER

Setpoint range:
Model 240, ±999.9° (temperature) or units. (Model 240H, ±9999° or units)

Program segments:
91, divisible into any number of programs.

Program cycles:
1 to 9999.

Segment time duration:
0 minutes to 99 hours and 59 minutes. (Optional: 0 seconds to 99 minutes and 59 seconds.)

External events:
Eight programmed open collector logic clamps, 40V dc max, 50mA max.

Process deviation limits:
+0.1 to 999.9° (or units).

Indicators:
Power on, Run, Program, Step select, Setpoint select, Alarm limit select, Segment time select, Events select, Scaling channel and min/max select, Deviation alarm, 8 events, remote computer active.

Numeric displays:
Step (segment); Channel 1 Setpoint/scaling/deviation limit; Channel 2 Setpoint/scaling/deviation limit; Segment time/cycle number.

Program memory:
Non-volatile; programs saved when power is lost. No internal or external batteries required.

Program restart:
Automatic resumption of program when power is restored.

Process deviation alarm action:
Any of the following activities may be selected:
—Flashing alarm limit indicator on front panel
—Alarm output
—Freeze program in current condition until deviation returns to within limits
—Freeze program in current condition until manually reset (Halt).

Optional Computer Communications Commands:
Either the IEEE-488 or the full RS-232C/RS-422A options provide these command capabilities:

Remote Computer switch position:

RUN	Starts operation
STP	Stops, halts operation
PRR	Reset to first step in present program
!	Enter data
CLR	Clears data
ULD	Upload–send entire programmer memory contents to computer
DLD	Download–load programmer memory with data from computer
SST	Select Step Mode
SCY	Select Cycles/End Of Program
SSC	Select Scale Mode

Operate or Remote Computer switch position:

SP1	Read current setpoint #1
SP2	Read current setpoint #2
PR1	Read current process variable #1
PR2	Read current process variable #2
TIM	Read time to go in current step
STN	Read current step number
CTG	Read no. of cycles to go in current program
DIP	Read internal DIP switch settings
LCK	Read position of keyswitch
ALM	Read alarm status
RQN	Service request enable (IEEE-488)
RQD	Service request disable (IEEE-488)
MOD	Read mode (Run, Stop, or End of Program)
?	Used during programming to read program parameters and to advance program pointer

Guaranteed soak:
Program waits at end of segment until process variable reaches within ±0.4° or ±1.6° (±0.4 or ±1.6 units) of setpoint. Selectable on either or both channels. This value is adjustable when the optional D to A converter is used.

Control inputs:
External inputs provided for Run, Stop and Reset. Two external interrupt inputs are also available for computer communications.

Digital Controller interface:
Dual 25-pin connectors, matching JCS Model 210 Digital Process Controller interface.

Analog setpoint output (Optional):
0-5V digital-to-analog converters with 15-bit resolution are available for each channel to provide setpoint outputs to controllers requiring analog setpoint inputs. The Model 240 provides front panel scaling controls for setting values from −999.9 to +999.9 units at the 0 and 5V levels (−9999 to +9999 on the 240H)

PHYSICAL CHARACTERISTICS

Size:
8¾" (222mm) high
19" (482mm) wide
7" (177mm) deep

Mounting:
Panel mount standard 19" rack with 8¾" rack space required

Weight:
14 lbs (6.35 kg)

Power requirements:
117V ac, 50-60 Hz, 250 Watts

ORDERING INFORMATION

MODEL 240 DUAL SETPOINT PROGRAMMER

with 91 segment program memory, dual digital setpoint outputs, 8 event outputs, programmable tracking alarm limits on each channel, locking operation keyswitch, and serial (300 baud) program upload/download capability.

	ORDER NO.
±999.9° or units	240
±9999° or units	240H

OPTIONS

	ORDER NO.
IEEE-488 Interface system	188P
RS-232/RS-422 Serial interface system, 300-4800 baud; includes address switch for multidrop. Up to 50 model 240s may be connected on a single RS-422A loop; single drop only with RS232C.	422SP
Ditigal-to-analog converter output, 0-5V (per channel)	A1504

ACCESSORIES

	ORDER NO.
Interface cable: JC Systems Digital Temperature Controller to the Model 240 Dual Setpoint Controller	K1001

JC SYSTEMS, INC.
11175 Flintkote Ave.
San Diego, CA 92121
(619) 453-9980

HOW TO USE THIS MANUAL

OVERVIEW OF CONTENTS

This manual contains complete instructions for installing and using the JC Systems Model 240 Programmer. The following material summarizes each chapter.

CHAPTER 1 - INTRODUCTION

Briefly describes programmer physical arrangement, important features, and equipment specifications.

CHAPTER 2 - INSTALLATION

Provides procedures for installation, connection, and interface of the programmer.

CHAPTER 3 - OPERATION

Step-by-step instructions for programming process parameters, including a complete description of all programmer controls and switches. Provides procedures for operating the programmer with JC Systems equipment, and with RS-232 or IEEE-488 interfaces to other equipment.

CHAPTER 4 - MAINTENANCE

Includes procedures for running self-test diagnostics and calibration of the digital-to-analog (D/A) converter.

TABLE OF CONTENTS

1. INTRODUCTION....1-1
1.1. INFORMATION PROVIDED....1-1
1.2. PROGRAMMER FEATURES....1-1
1.3. SWITCH-SELECTABLE FEATURES....1-2
1.4. PARAMETERS STORED....1-2
1.5. PROGRAM REVIEW/DISPLAY....1-3
1.5.1. OPERATE-RUN....1-3
1.5.2. OPERATE-STOP....1-4
1.5.3. PROGRAM....1-4
1.6. COMPUTER INTERFACING....1-4
1.6.1. STANDARD RS-232 INTERFACE....1-4
1.6.2. IEEE-488 INTERFACE OPTION....1-4
1.6.3. RS-232/RS-422 PARALLEL COMMUNICATIONS OPTION....1-5
1.7. PRINCIPAL COMPONENTS....1-5
1.7.1. FRONT PANEL....1-5
1.7.1.1. Front Panel Switch Board....1-5
1.7.1.2. Front Panel Display Board....1-5
1.7.2. CONTROL LOGIC BOARD....1-9
1.7.3. REAR PANEL....1-9
1.7.4. OPTIONAL BOARDS....1-9
1.7.4.1. Computer Interface....1-9
1.7.4.2. Analog Setpoint Output....1-10
1.8. SPECIFICATIONS AND REFERENCE DATA....1-10

2. INSTALLATION....2-1
2.1. UNPACKING....2-1
2.2. MOUNTING....2-1
2.2.1. RACK MOUNTING....2-1
2.2.2. BENCH MOUNTING....2-1
2.3. ELECTRIC CONNECTIONS AND INTERFACING....2-1
2.3.1. DIGITAL CONTROLLER INTERFACES....2-1
2.3.2. EXTERNAL CONTROL SIGNALS....2-5
2.3.3. RS-232 COMMUNICATIONS INTERFACE....2-6
2.3.4. IEEE-488 COMPUTER INTERFACE....2-6
2.3.5. RS-232/RS-422 INTERFACE....2-6
2.3.5.1. Voltage Connections....2-6
2.3.5.2. RS-232/RS-422 Interface Switch Settings..2-8
2.3.6. IEEE-488 SERVICE REQUEST FUNCTION....2-9
2.3.6.1. Service Request Enable/Disable....2-9
2.3.6.2. Service Request DIP Switch Settings....2-9
2.3.6.3. Service Request (Serial Poll) Data....2-10
2.4. SWITCH-SELECTABLE FEATURES FOR STANDARD PROGRAMMER....2-10
2.4.1. WINDOW 1 - CHANNEL 1 GUARANTEED SOAK....2-10
2.4.2. CHANNEL 1 NULL BAND....2-11
2.4.3. WINDOW 2 - CHANNEL 2 GUARANTEED SOAK....2-11
2.4.4. CHANNEL 2 NULL BAND....2-11
2.4.5. TIME SCALE SETTING....2-11
2.4.6. LOCAL/SETPOINT HOLD....2-11
2.4.7. ALARM/AUTO RESET....2-11
2.4.8. RUN DURING DEVIATION....2-12

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3. OPERATION.....3-1
3.1. INFORMATION PROVIDED.....3-1
3.2. SWITCHES AND DISPLAYS.....3-1
3.3. SWITCH-SELECTABLE FEATURES.....3-1
3.4. PROGRAMMING.....3-9
3.4.1. ENTERING A PROGRAM.....3-9
3.4.1.1. General Instructions.....3-9
3.4.1.2. Special First Segment Features.....3-9
3.4.1.3. Select Starting Step.....3-10
3.4.1.4. Enter Channel 1 Setpoint.....3-10
3.4.1.5. Enter Channel 1 Alarm Limits.....3-10
3.4.1.6. Enter Channel 2 Setpoint.....3-11
3.4.1.7. Enter Channel 2 Alarm Limits.....3-11
3.4.1.8. Enter Time (Segment Duration).....3-11
3.4.1.9. Enter Selected Events.....3-11
3.4.1.10. Enter Parameters for Remaining Steps...3-11
3.4.1.11. End Program.....3-12
3.4.2. STORING MULTIPLE PROGRAMS.....3-12
3.4.2.1. Program Length.....3-12
3.4.2.2. Programmer Memory Capacity.....3-12
3.4.2.3. Importance of End-of-Program Step.....3-12
3.4.3. SCALING.....3-13
3.5. OPERATION.....3-14
3.5.1. DIRECT PROGRAMMER OPERATION.....3-14
3.5.1.1. OPERATE-RUN Mode.....3-14
3.5.1.2. OPERATE-STOP Mode.....3-14
3.5.2. EXTERNAL OPERATION.....3-15
3.5.2.1. External Control Inputs.....3-15
3.5.2.2. Computer Access -- OPERATE-RUN Mode.....3-15
3.5.2.3. REMOTE COMPUTER ACTIVE Mode.....3-17

4. MAINTENANCE.....4-1
4.1. DIGITAL/ANALOG CONVERTER CALIBRATION.....4-1
4.2. PROGRAMMER TEST PROCEDURE.....4-2
4.2.1. POWER-UP AND THRESHOLD TEST.....4-2
4.2.2. FRONT PANEL SWITCH AND DISPLAY TEST.....4-2

APPENDIX A. MODEL 240 PROFILE WORKSHEET A-1

LIST OF FIGURES

1-1. Programmer Interconnect Diagram -- Standard Version.....1-6
1-2. Programmer Interconnect Diagram -- RS-232/RS-422 Version.....1-7
1-3. Programmer Interconnect Diagram -- IEEE-488 Version.....1-8

2-1. Rear Panel Connectors -- Standard Configuration.....2-2
2-2. Rear Panel Connectors -- RS-232/RS-422 Configuration.....2-3
2-3. Rear Panel Connectors -- IEEE-488 Configuration.....2-4
2-4. RS-232/RS-422 Parallel Communication Connections.....2-7
2-5. Z33 DIP Switch Settings (for Standard Programmer).....2-10

3-1. Key to Front Panel Switches and Displays.....3-2
3-2. Format for Remote Computer Commands.....3-16

LIST OF TABLES

1-1. SUMMARY OF PROGRAM PARAMETERS 1-3
1-2. SPECIFICATIONS AND REFERENCE DATA.....1-10

2-1. PIN ASSIGNMENTS FOR INTERFACE CONNECTORS J6 AND J7.....2-5
2-2. RS-232/RS-422 PORT PIN ASSIGNMENTS.....2-7

3-1. EXPLANATION OF FRONT PANEL SWITCHES AND DISPLAYS.....3-3
3-2. PROGRAMMING SUMMARY.....3-8
3-3. COMPUTER ACCESS COMMANDS FOR OPERATE-RUN MODE.....3-16
3-4. COMPUTER COMMANDS FOR REMOTE COMPUTER ACTIVE MODE.....3-17

4-1. PROGRAM FOR CALIBRATING D/A CONVERTER.....4-1

CHAPTER 1. INTRODUCTION

1.1. INFORMATION PROVIDED

This chapter describes major programmer features. Included are a description of the overall system and its principal components. Electrical and physical characteristics of the programmer are summarized in a table at the end of the chapter.

1.2. PROGRAMMER FEATURES

The Model 240 Dual Setpoint Programmer is designed to program direct digital control of JCS digital process controllers, as well as a wide variety of analog-type controllers. The Model 240 can operate alone, or it can be used with a computer via IEEE-488 or RS-232C/RS-422A communication interfaces. The JCS programmer enables such process variables as temperature, pressure and humidity to be readily programmed and monitored in a wide variety of applications. Principal programmer features are tabulated below.

- Ease of use
- Multiple program storage
- 90-segment program memory
- Eight programmable external events
- Program information retrieved at touch of a switch
- All parameters for each segment individually programmed and stored
- Programmed parameters continually displayed during run
- Programmable alarm limits track process variations against specified setpoint throughout segment
- Automatic scaling with digital controllers
- Front panel scaling for other controllers when optional digital-to-analog module installed to supply analog commands
- Non-volatile memory -- programs permanently saved, even when power loss occurs, without any internal or external battery
- Secured access using locking keyswitch

- Three photocoupled inputs provided for remote external control (run, stop and reset)

- Standard RS-232 port provides serial communications with computer

- Optional IEEE-488 or RS-232C/RS-422A interface permits wide range of computer commands, interrogations and interrupts

1.3. SWITCH-SELECTABLE FEATURES.

In addition to the above capabilities, the JCS Model 240 Programmer offers several switch-selectable features designed to simplify its use and increase its versatility. These are tabulated below; instructions for selecting these features are provided in Chapter 2.

- Program segment duration can be based on either hours and minutes or minutes and seconds

- Guaranteed soak ensures soak to within $\pm$0.4 units of programmed setpoint

- Automatic null check stops operation when the process variable is outside limits for JCS digital controllers; also functions when D/A converters installed

- Setpoint mode switch permits either using the same setpoint specified at program end, or entering a different setpoint from the controller front panel after the program ends

- Automatic program freeze when deviation alarm limits exceeded

- Automatic reset when process variable returns within limits

- Run during deviation switch permits continued operation even when alarm limits have been exceeded.

1.4. PARAMETERS STORED

Table 1-1 summarizes the parameters stored, the range of settings for each, and their application or use.

TABLE 1-1. SUMMARY OF PROGRAM PARAMETERS

PARAMETER	RANGE OF SETTINGS	APPLICATION
Setpoint for Channel 1	- 999.9 thru + 999.9	Specify absolute unit value to be used for measured property in this segment; degrees for temperature, percent for humidity, psi for pressure, etc.
Alarm limits for Channel 1	0.1 thru 999.9	Specify allowable deviation in either direction from the setpoint for this segment; for example, an alarm limit of 5.0 provides a deviation band of ±5 units or tolerance of ±5.0
Setpoint for Channel 2	*****	Same range and application as Channel 1 *****
Alarm limits for Channel 2	*****	Same range and application as Channel 1 *****
Time (segment duration)	0 minutes thru 99 hours, 59 minutes	Specify length of time for each segment NOTE: Switch-selectable to minutes and seconds mode. See Chapter 2.
Cycles	1 thru 9999	Any program may be repeated for up to 9999 cycles without using additional program memory.

1.5. PROGRAM REVIEW/DISPLAY

A keyswitch on the front selects the program modes, the displays for which are defined below.

1.5.1. OPERATE-RUN.

With the keyswitch in OPERATE position and the RUN switch pressed (RUN LED is on), programmer displays current STEP (segment) number, Channel 1 and 2 setpoints, actual time remaining, and EVENTS status (programmed events have lighted LED). To view final setpoints or programmed segment duration, press the corresponding SELECT switch. To display cycles remaining, press END PROGRAM/CYCLES switch. To return program to first step, press RESET PRGM switch.

1.5.2. OPERATE-STOP.

With the keyswitch in OPERATE position and the STOP switch pressed (STOP LED is on), programmer displays only the programmed settings that are active for the current segment (step), as indicated by a a lighted LED above the applicable switches. To review settings at other steps, press the STEP REV or STEP FWD switch until the desired segment number is displayed.

NOTE

Holding down the STEP REV or STEP FWD switch causes the segment pointer to slew (move rapidly) in the specified direction.

1.5.3. PROGRAM.

With the keyswitch in PROGRAM position, the programmer displays the current programmed value for one parameter, identified by a lighted LED above it. When that value is re-entered or changed, the program pointer automatically advances to the next parameter. Within a given segment (STEP), you can use the STEP REV or STEP FWD switch to move the program pointer to a different parameter.

1.6. COMPUTER INTERFACING

1.6.1. STANDARD RS-232 INTERFACE

The programmer includes an RS-232 port that permits interfacing with a remote computer. Programs may be developed on the Model 240 and then stored in computer memory (uploaded), or transferred from the computer to Model 240 memory (downloaded). The remote computer also has complete access to the programmer. With the MODE SELECT keyswitch in the OPERATE position, the remote device can read all current parameters. With the MODE SELECT keyswitch in the REMOTE COMPUTER ACTIVE position, the remote device can also direct programmer operations (run, stop, etc.), as well as command uploading or downloading of programs. The full list of computer-generated commands and queries is given in Chapter 3.

1.6.2. IEEE-488 INTERFACE OPTION

This optional interface provides a remote IEEE-488 controller or computer with the same command and communications capabilities as the RS-232 interface described in Para. 1.6.1. In addition, the IEEE-488 option includes the capability to generated a service request (serial poll) at user-selected events.

1.6.3. RS-232C/RS-422A PARALLEL COMMUNICATIONS OPTION

This option provides the same capabilities as the above interfaces (excluding the IEEE-488 service interrupt), but in RS-232C/RS-422A party-line, parallel communications format. Up to 50 Model 240 Programmers can share a single serial port.

1.7. PRINCIPAL COMPONENTS

As shown on the interconnect diagrams, Figure 11 thru 1-3, the principal components of the programmer are its printed circuit board assemblies. The three diagrams show differences in programmer configurations that depend on the options selected -- standard, RS-232/RS-422, or IEEE-488.

1.7.1. FRONT PANEL

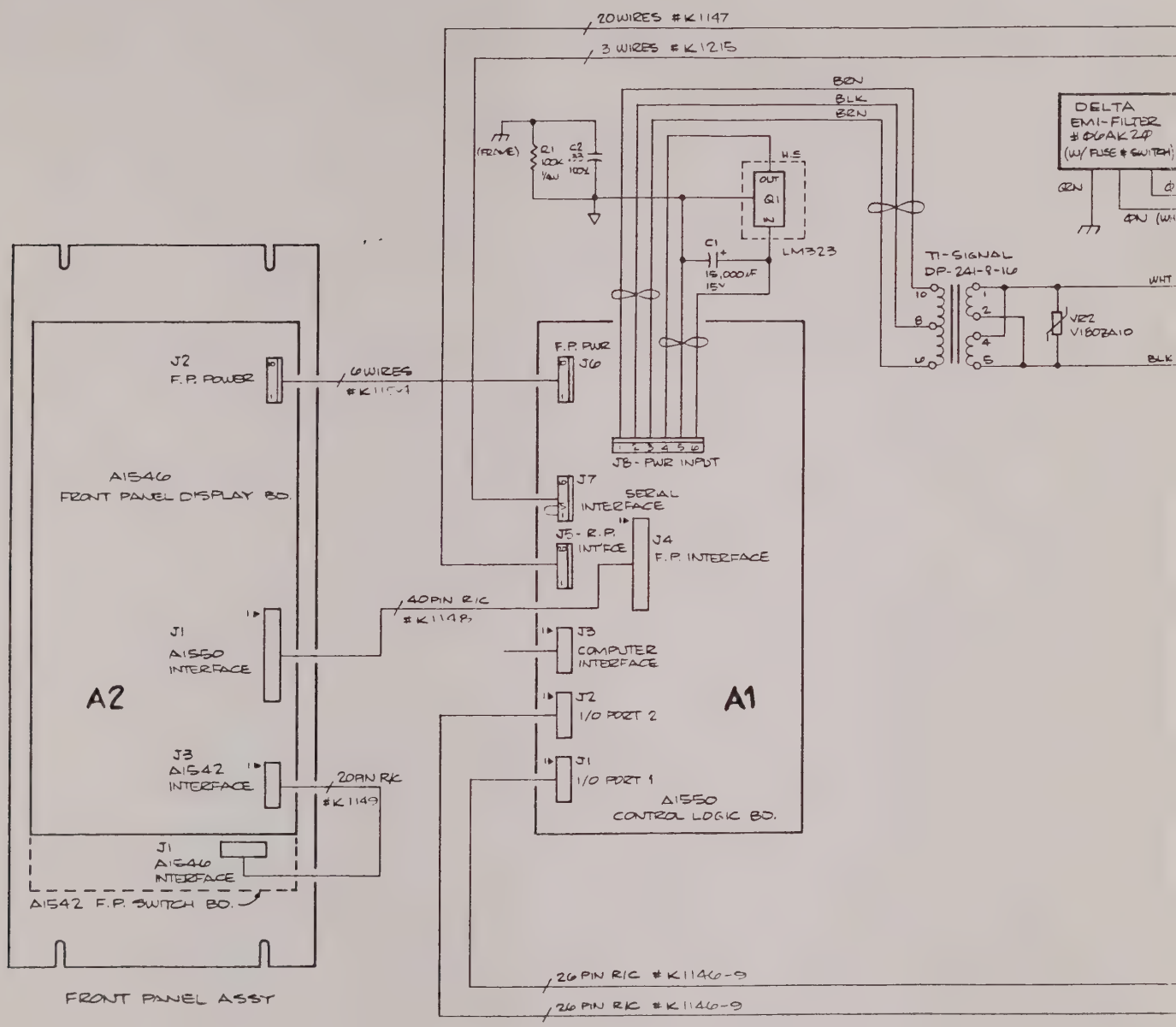
The front panel groups all switches and displays used to generate, store, and use programs into three logical functions, each bordered by heavy white lines. At the lower left, the keyswitch used to select OPERATE or PROGRAM mode and the keypad used to enter program parameters. At the top, displays, indicators, and switches used to review parameters. At the lower right, the two switches and indicators used to set scaling for analog outputs. The front panel consists of two circuit boards, which are described below.

1.7.1.1. Front Panel Switch Board

That portion of the front panel you use to enter a program. Signals from the various switches are transmitted via a 20pin ribbon cable from connector J1 on the front panel switch board to J3 on the front panel display board.

1.7.1.2. Front Panel Display Board

That portion of the front panel which displays the current value or status for each parameter is the visible portion of the display board. However, this board also contains circuitry to interface both front panel boards with the control logic board. Z33, the DIP (dual inline package) switch used to select features described in Para. 1.3, is mounted on the rear side of this board.

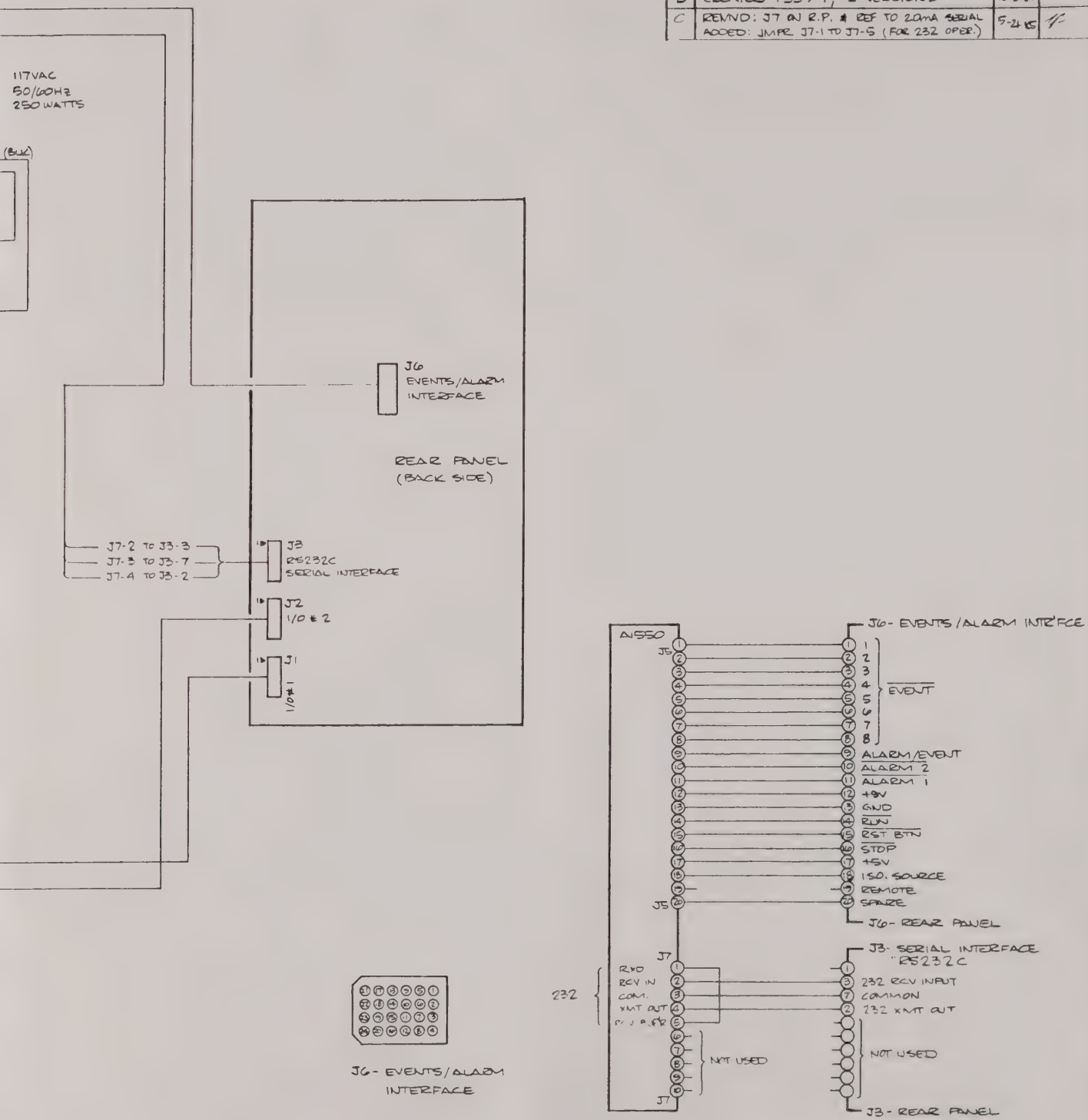


⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

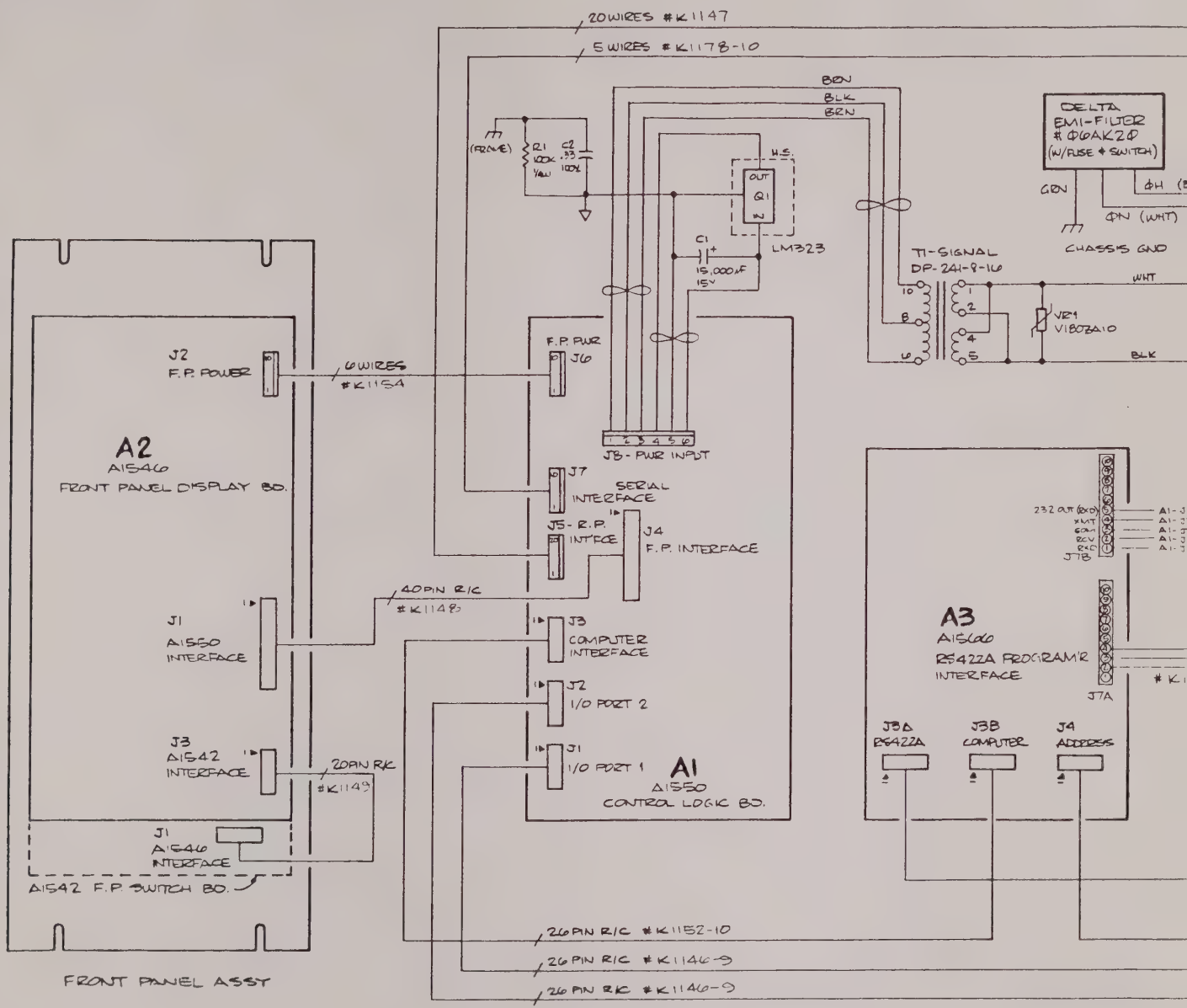
NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ADDED R1 & C2; REMOVED: A1593, J1-2 TO J6-17; A1550 J5-19 TO J6-19	10-25-83	
	B	CREATED 1559-1; -2 VERSIONS	10-2-84	
	C	REVND: J7 ON R.P. & REF TO 20mA SERIAL ADDED: JMPR J7-1 TO J7-5 (FOR 232 OPER.)	5-24-85	



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES 0° 30' HOLE TOLERANCES .013 THRU .250 ± .004 .251 THRU .501 ± .006	ENGINEERING ACTIVITY	SYSTEMS, INC.	
	DESIGN JC SYSTEMS INC.	TITLE: STANDARD VERSION — INTERCONNECT DIAGRAM — MODEL 240 PROGRAMMER	
	DRAFTED • 23 SEPT 1983		
	CHECKED		
DASH QTY N	APPL 2401084		

Figure 1-1. Programmer Interconnect Diagram -- Standard Configuration.



2 FINISH (IF APPLICABLE)

1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

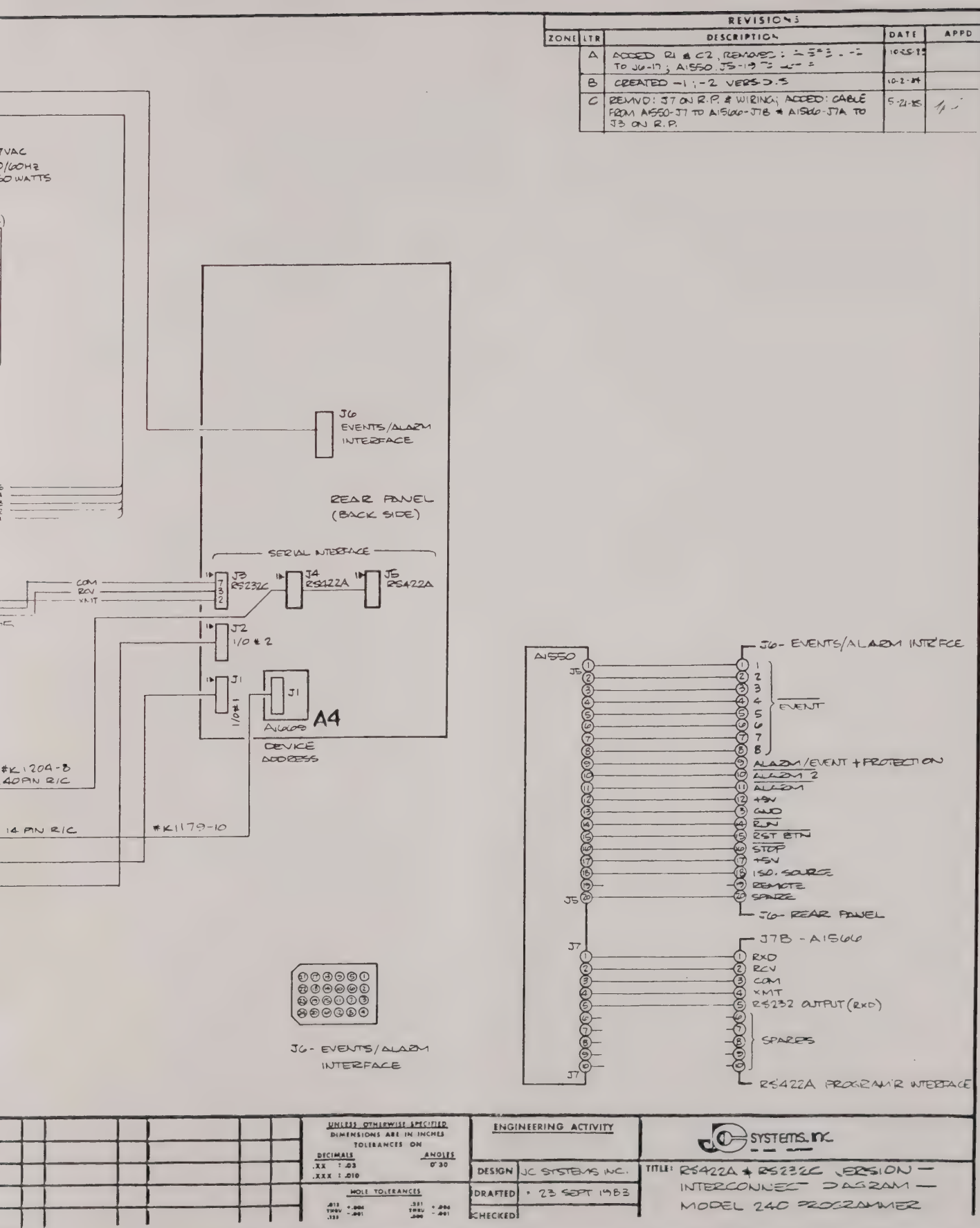
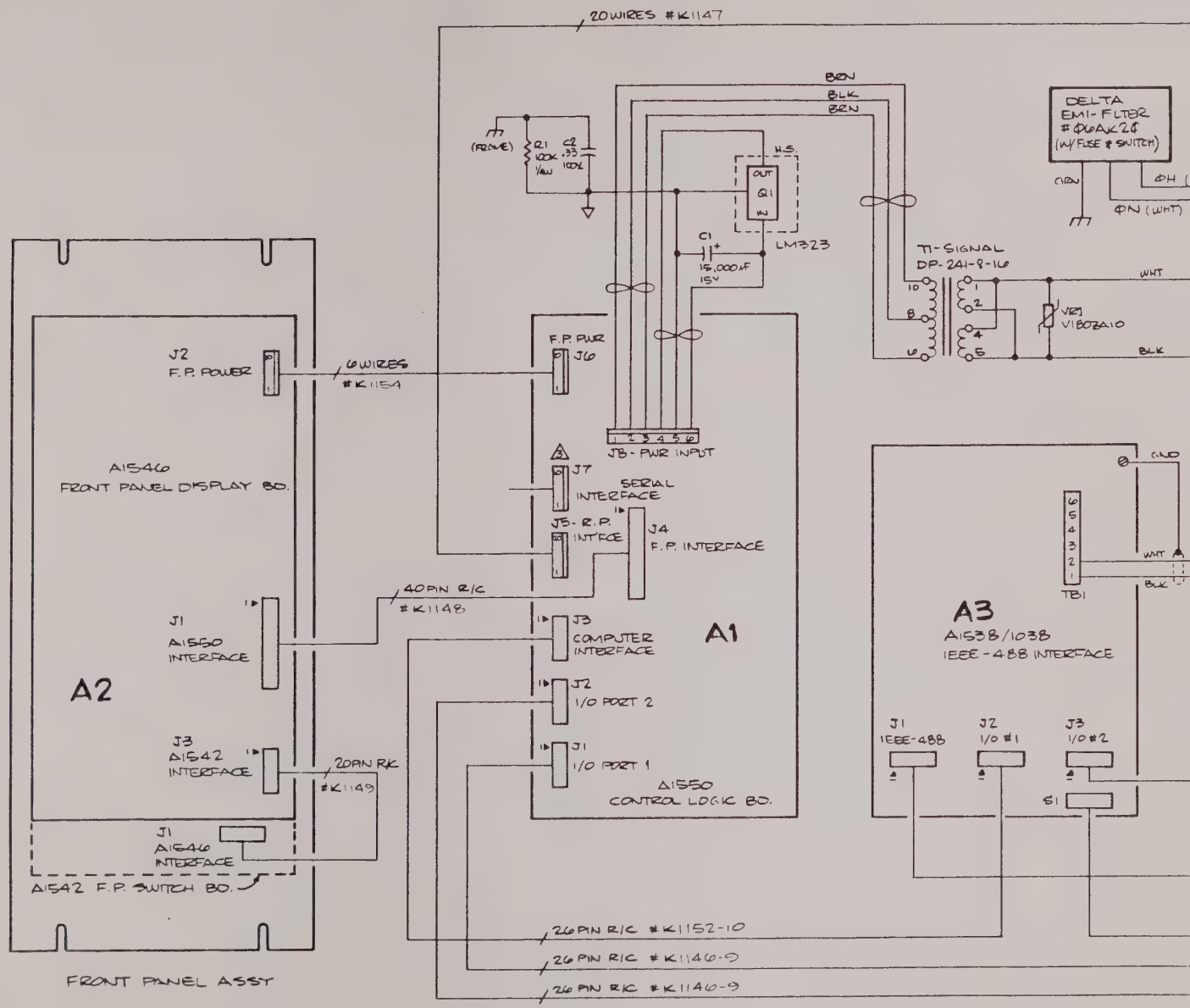


Figure 1-2. Programmer Interconnect Diagram -- RS-232/RS-422 Configuration.



2 FINISH (IF APPLICABLE)

1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

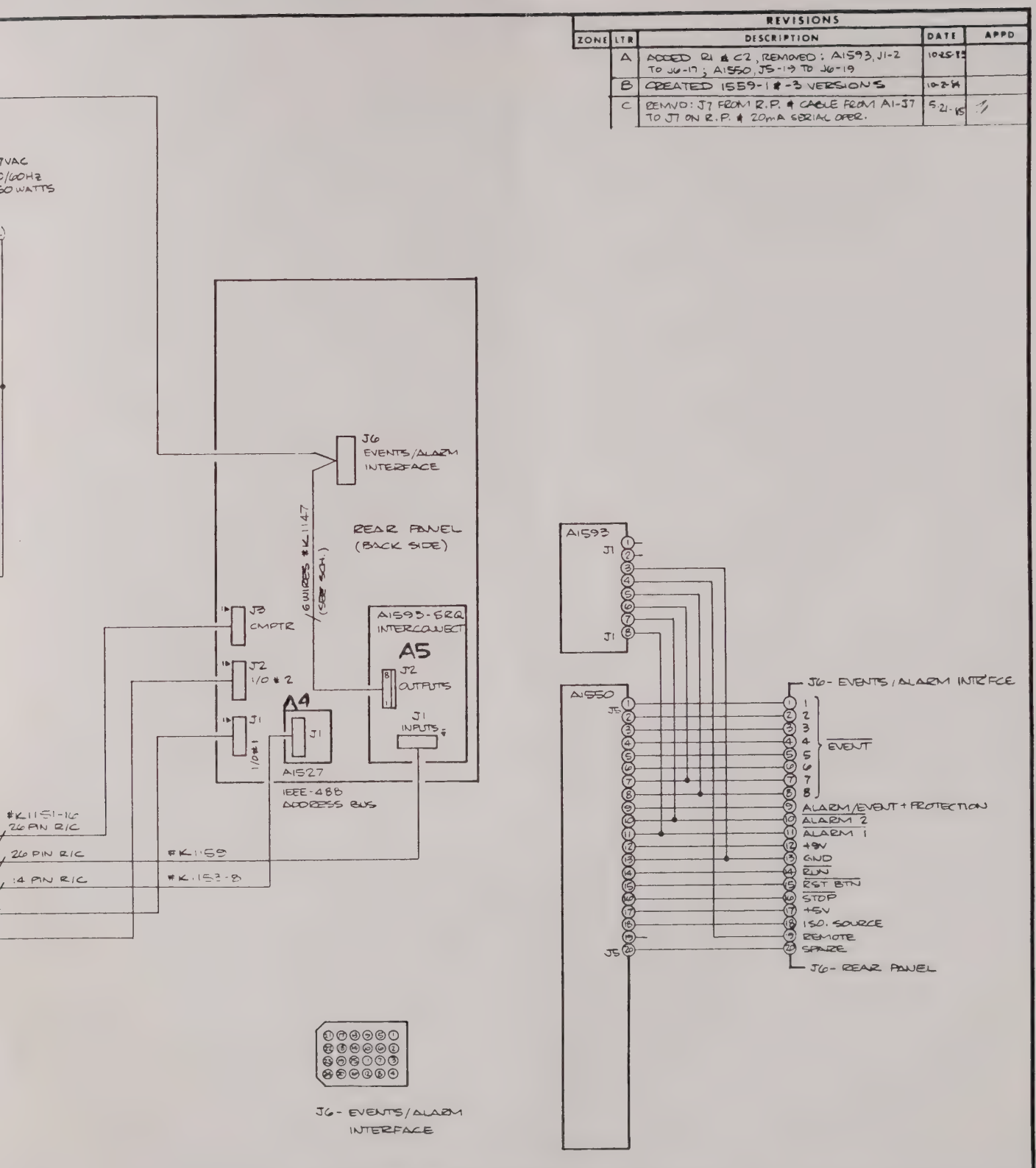


Figure 1-3. Programmer Interconnect Diagram -- IEEE-488 Configuration.

1.7.2. CONTROL LOGIC BOARD

The heart of the programmer, the control logic board receives, processes, and transmits signals. It stores program parameters and compares these against data inputs from external controllers or monitors, changing displays and initiating alarms as appropriate. When a computer is connected to the system, the control logic board relays and interprets computer-originated program commands, changes, or interrupts. Ribbon cables interface the control logic board with the programmer's front panel at J4, the RS-422 or IEEE-488 computer interface at J3, and the controller I/O (input/output) ports on the rear panel at J1 and J2. The logic board receives power through J8 and supplies power to the front panel through J6. Interface with rear panel circuitry is via J5, while the standard serial interface is through J7 to the rear panel.

1.7.3. REAR PANEL

The rear panel provides connectors to mate the programmer with two digital controllers (J1 and J2) and a 20-ma current loop serial interface (J7). Connector J3 provides the computer interface for the standard RS-232C configuration of either serial configuration. When a parallel communications option has been installed, J4 and J5 are the connection points for devices on the party line. External control signals enter the programmer through pins of the events/alarm interface connector J6. Instructions for making all these terminations are provided in Chapter 2.

1.7.4. OPTIONAL BOARDS

1.7.4.1. Computer Interface

The IEEE-488 or RS-232/RS-422 interface options each requires a different board that controls interface logic and communications. A SRQ interconnect module (A1593) is mounted on the rear panel when the IEEE-488 interface option has been installed. This board relays signals from the IEEE-488 interface board to events/alarm interface connector J6 on the rear panel. It also contains the dip switch used to select service request interrupts.

Both the RS-422 and the IEEE-488 interfaces include an address switch mounted on the rear panel. This is used to create a unique identifying address number for each programmer used in the communication network.

1.7.4.2. Analog Setpoint Output

One 16-bit digital to analog converter board per channel can provide channel output in analog form for controllers requiring analog setpoint inputs. The programmer's front panel scaling capability permits translating the 0 to 5 volt signals to engineering units with corresponding values of -999.9 thru +999.9.

1.8. SPECIFICATIONS AND REFERENCE DATA

Table 1-2 summarizes the electrical and physical characteristics of the programmer.

TABLE 1-2: SPECIFICATIONS AND REFERENCE DATA.

CHARACTERISTIC	DESCRIPTION
Setpoint range	±999.9 units
Program segments	90 max. (includes 1 EOP)
Cycles per program	As many as 9999
Program duration	99 hours and 59 minutes per segment max (or 99 minutes and 59 seconds max)
Program memory	Stores multiple programs; number stored depends on segments/program
External events programming	8 open collector logic clamps, 40Vdc max, 50mA max.
Scaling	Automatic with JCS controllers; front-panel scaling with optional D/A converters
Process deviation limits	0.1 thru 999.9 units
Soak	Guaranteed soak holds program until process variable within ±0.4 units of setpoint
Memory	Non-volatile; no batteries required
Alarm actions	Flashing visual signal; output to audible signal; program freezes until reset or within limits (user-selected)

Table 1-2 (Cont.)

CHARACTERISTIC	DESCRIPTION
Controller Interfaces	Dual 25-pin connectors match JCS digital controllers Optional D/A converters provide analog setpoints for analog controllers
Computer Interfaces	RS-232C communications standard IEEE-488 or RS-232C/RS-422A optional
Dimensions (W x H x D)	19 x 8.75 x 7 in. (482 x 222 x 177 mm)
Weight	14 lbs (6.35 kg)
Mounting	Standard 19 in. electronic rack, 8.75 in. vertical rack space
Power	117Vac, 50-60 Hz, 250W

CHAPTER 2. INSTALLATION

2.1. UNPACKING

Remove all protective packing and tiedowns from the programmer and remove programmer from its shipping container.

2.2. MOUNTING

2.2.1. RACK MOUNTING

Mount the programmer in a standard 19-in. electronic rack, allowing at least 8-3/4 in. rack space to accommodate its height.

2.2.2. BENCH MOUNTING

For bench use, be sure to install rubber feet (available at no charge from JC Systems) on bottom of programmer to prevent damage to benchtop.

2.3. ELECTRIC CONNECTIONS AND INTERFACING

Figure 2-1 identifies the rear panel location and function of external electrical power and electronic communication interface connectors. These are further defined below.

2.3.1. DIGITAL CONTROLLER INTERFACES

Using JCS P/N K1001 3-foot ribbon cables supplied, connect digital controller #1 to Channel 1 at I/O port J1, and connect digital controller #2 to Channel 2 at I/O port J2.

Figure 2-1. Rear Panel Layout -- Standard Configuration.

Figure 2-2. Rear Panel Layout -- RS-232/RS-422 Configuration.

Figure 2-3. Rear Panel Layout -- IEEE-488 Configuration.

2.3.2. EXTERNAL CONTROL SIGNALS

To input external RUN, STOP and RESET control signals, use a 24-pin Molex connector (supplied) wired to interface with appropriate pins of J6 events/alarms interface. (See Table 2-1 for J6 pin assignments.) Note that these are photo-coupled input lines, and the source voltage (J6-18) must be connected to a +5V, 50mA power supply. The user can supply external 5v power to provide photo-isolation, or use the programmer's internal 5V supply.

If the internal power supply is used, jumper J6 Pins 17 and 18 and connect the external switch common line to J6-13. If an external power supply is used, connect the +5V to J6-18 and connect the external switch common to the ØV connection of the external power supply.

TABLE 2-1. PIN ASSIGNMENTS FOR INTERFACE CONNECTORS J6 AND J7.

EVENTS/ALARM INTERFACE J6 - 24-PIN MOLEX SOCKET		RS-232 SERIAL INTERFACE CURRENT PORT J7 - 12-PIN MOLEX SOCKET	
PIN #	FUNCTION	PIN #	FUNCTION
1	Event 1	1	Jumper
2	Event 2	2 - 4	Not used
3	Event 3	5	Jumper (232 voltage connection)
4	Event 4		
5	Event 5	6	Jumper (20mA loop)
6	Event 6	7	20mA ser. loop in (+)
7	Event 7	8	20mA ser. loop in (-)
8	Event 8	9	20mA ser. loop out (-)
9	Protection Connection +	10	20mA ser. loop out (+)
10	Alarm #2 output		
11	Alarm #1 Output		
12	+ 9 V DC unregulated internal source (100 mA max)		
13	0 V DC (circuit common)		
14	Run command		
15	Reset to start of program command		
16	Stop command		
17	+ 5 V DC regulated internal logic power supply (50 mA max)		
18	+ Isolated source voltage input		
19	Remote input (IEEE-488 option)		

2.3.3. RS-232 COMMUNICATIONS INTERFACE

To enable communication via the standard RS-232 serial interface port, connect a suitable cable to J3, a 25-pin D subminiature connector. The non-adjustable baud rate for this serial interface is 300. Parity is not required or transmitted. RS-232 voltage connections are via J3 as follows:

Transmit - Pin 2 **Receive Data** - Pin 3 **Common** - Pin 7

If using the 20mA current loop instead of RS-232C voltage connections, cut the jumper between Pins 5 and 1 of J7 and add a jumper between Pins 6 and 1 of J7. Alternate connections for the 20-ma current loop are also shown in Table 2-1.

2.3.4. IEEE-488 COMPUTER INTERFACE

If the IEEE-488 computer interface option is installed, connect interface cable at port J3 and set service request function switches per Para. 2.3.6.

2.3.5. RS-232/RS-422 INTERFACE

With the RS-232/RS-422 option, up to 50 Model 240 programmers may communicate in parallel with a single master computer. However, care must be taken to correctly connect the programmers and the master computer. Several switch positions also must be selected based on system configuration. These requirements are detailed in the following paragraphs.

2.3.5.1. Voltage Connections

1. RS-232 voltage-level connections are via connector J3 as described in Para. 2.3.2 above.

2. RS-422 voltage-level connections from the computer to the first programmer on the party line are via RS-422 Port J4, a 37-pin "D" type miniature connector, as shown in Figure 2-4. (Pin assignments are given in Table 2-2.) Port J5 on the first programmer then connects to Port J4 on the second programmer. Subsequent programmers in the series connect in the same manner as the first pair.

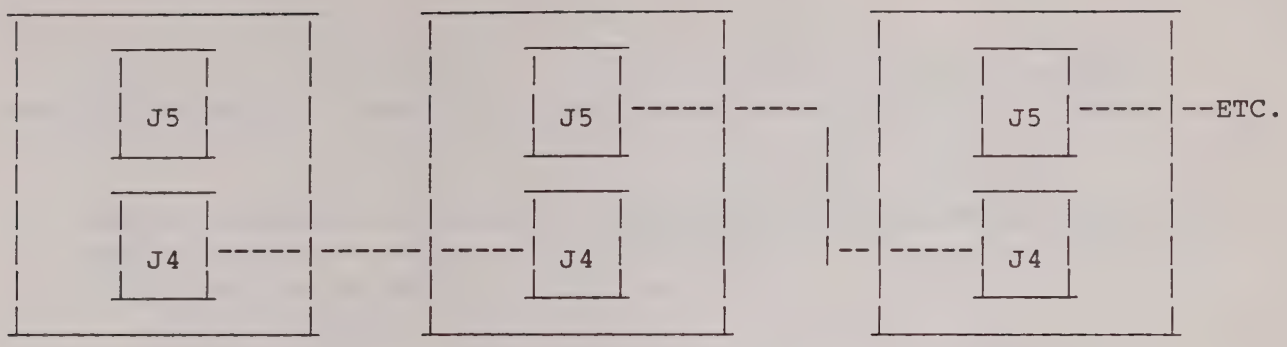


Figure 2-4. RS-232/RS-422 Parallel Communication Connections.

TABLE 2-2. RS-232/RS-422 PORT PIN ASSIGNMENTS.

COMMAND	SIGNAL	COMPUTER TO UNIT#1 J4 PIN NO.	UNIT #1 TO UNIT #2 J5 PIN NO.	UNIT #2 TO UNIT #3 J4 PIN NO.
Send Data (to Master Computer)	SD (A)	4	4	4
	SD (B)	22	22	22
Receive Data (from Master Computer)	SD (A´)	6	6	6
	SD (B´)	24	24	24
Signal Ground	SG	19	19	19

2.3.5.2. RS-232/RS-422 Interface Switch Settings

The following switches must be set as specified to ensure correct party-line parallel operation. To gain access to internal switches, remove five screws securing the top cover and remove the cover.

1. **Address Switch** on programmer rear panel -- this direct-reading switch should be set to a different number (address) for each programmer connected to the system.

NOTE

The user will need these addresses to communicate command and status information from the master computer to the programmers. Therefore, a hard-copy address chart posted near the computer showing the address and physical location of each programmer might prove useful in some applications.

2. **RS-232C/RS-422A Select Switch** S3 on A1566 Interface Board -- set to RS-232C (down) position for serial communications between a single computer and programmer, or to RS-422A (up) position for parallel communications between a single computer and several programmers.

3. **Baud Rate Dip Switch S1** on A1566 -- Select a baud rate of 300, 600, 1200, 2400, 4800, or 9600 by placing that switch in the ON (down) position. (9600 is the maximum baud rate for Model 240 programmer communications.) All other S1 switches must be in the OFF (up) position, and all baud rate switches on all programmers sharing party-line parallel communications must be set to the same rate.

4. **Protocol DIP Switch S2** on A1566 -- Only Position 4, Bus Terminated, is currently used. If only one programmer is connected to computer, set Position 4 to ON (down, terminated). If more than one programmer is connected, terminate the **last unit only;** leave all other 240 Bus Terminated switches set in the Unterminated (up) position. Set spares (positions, 1 thru 3, 5 and 6) to OFF (up, not used).

2.3.6. IEEE-488 SERVICE REQUEST FUNCTION

The IEEE-488 option includes a service request feature which, when enabled, causes the programmer to generate a service request (serial poll) when a deviation alarm condition begins, and again when it ends. The user can also set switches on the SRQ board, which is mounted on the programmer rear panel, to generate a service request at selected events.

2.3.6.1. Service Request Enable/Disable

To enable the service request function, an RQN command must be transmitted by the computer while the programmer is in REMOTE COMPUTER ACTIVE mode. An RQD command transmitted in the same mode disables the service request.

2.3.6.2. Service Request DIP Switch Settings

Service request DIP switch positions are marked YES/NO. Selecting the YES position generates a service request; the NO position prevents one. Selecting the YES position for both the Event ON and Event OFF will generate a service request both when the event turns ON and when it turns OFF. Switch positions and corresponding events are identified below.

1. Positions 1 and 2 control service requests when Event 7 turns OFF and ON, respectively.
2. Positions 3 and 4 control service requests when Event 8 turns OFF and ON, respectively.

NOTE

Event 8 and the External Interrupt (positions 5 and 6) share common access to the IEEE-488 interface, so do not select both at the same time.

3. Positions 5 and 6 allow the External Interrupt Input access to the IEEE-488 interface. Connect inputs to J6 Pin 19 (external interrupt) and J6 Pin 13 (0V) from an isolated set of contacts. Connecting J6 Pin 19 to Pin 13 causes an interrupt if the RQN command has been generated.

2.3.6.3. Service Request (Serial Poll) Data

The unit generating the service request is polled afterwards, and all bits are automatically reset. The other six bits contain the following information, as applicable.

Bit 0 set -- Channel 1 Alarm is ON
Bit 1 set -- Channel 1 Alarm status change
Bit 2 set -- Channel 2 Alarm is ON
Bit 3 set -- Channel 2 Alarm status change
Bit 4 set -- Event 7 ON/OFF (switch selectable)
Bit 5 set -- Event 8 ON (switch selectable)
Bit 6 set -- When any condition causes a Service Request
Bit 7 set -- Programmer failure

2.4. SWITCH-SELECTABLE FEATURES FOR STANDARD PROGRAMMER

Certain operating characteristics of the standard Model 240 also may be modified by changing settings for DIP switch Z33 (Figure 2-5) on the front panel display board A1546 as follows.

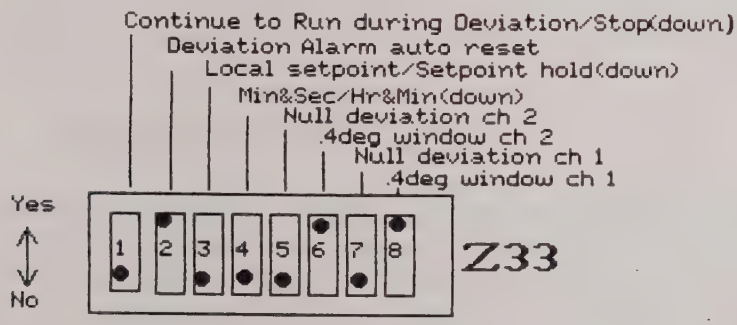


Figure 2-5. Z33 DIP Switch Settings (for Standard Programmer).

2.4.1. WINDOW 1 - CHANNEL 1 GUARANTEED SOAK

When the .4DEG WINDOW CH 1 switch, position 8, is set to YES position, the programmer will wait (even though segment duration has elapsed) until the process variable is within the setpoint ± 4 of the least significant units being displayed. [In other words, 0.4 for a standard (tenths) system or 4 for a units system.] During this guaranteed soak window, the programmer will hold operation (colon in TIME/CYCLES display will stop flashing) until process variable is within the 4-unit limit.

2.4.2. CHANNEL 1 NULL BAND

When the NULL DEVIATION CH 1 switch, position 7, is set to YES position, the programmer will stop if the process variable is outside the null band. This value is typically ±1.6 for JCS Controllers. The feature also works with the 0-5V D/A converter installed.

2.4.3. WINDOW 2 - CHANNEL 2 GUARANTEED SOAK

The .4 DEG WINDOW CH 2 switch, position 6, works in the same manner as WINDOW CH 1, but for Channel 2.

2.4.4. CHANNEL 2 NULL BAND

The NULL DEVIATION CH 2 switch, position 5, works in the same manner as NULL DEVIATION CH 1, but for Channel 2.

2.4.5. TIME SCALE SETTING

When the MIN&SEC/HR&MIN switch, position 4, is set to YES (MIN&SEC) position, time can be measured in minutes and seconds from 0 seconds to 99 minutes, 59 seconds. In the NO (HR&MIN) position, time can be measured in hours and minutes from 0 minutes to 99 hours and 59 minutes.

2.4.6. LOCAL SETPOINT/SETPOINT HOLD

When the LOCAL SETPOINT/SETPOINT HOLD switch, position 3, is set to YES (LOCAL SETPOINT) position, program control reverts to the front panel of the controller. This allows the user to input a final setpoint after the program ends. When the switch is set to NO (SETPOINT HOLD) position, the setpoint specified at the end of the program (in program memory) will be used as the final setpoint.

2.4.7. ALARM AUTO RESET

Placing the DEVIATION ALARM AUTO RESET switch, position 2, to OFF (no AUTO RESET) causes the following: whenever alarm limits are exceeded, the programmer stops (TIME/CYCLES colon stops flashing), the alarm limit energizes, and the applicable SELECT ALARM LIMIT LED flashes. These conditions continue until parameters returns within limits and the RUN switch is actuated (by manual or remote computer operation).
When the switch is set to YES (AUTO RESET), the programmer will automatically resume operation as soon as an out-of-limits condition has ended. At the same time, the alarm outputs are automatically reset.

2.4.8. RUN DURING DEVIATION

When the CONTINUE TO RUN DURING DEVIATION switch, position 1, is set to ON, the programmer will continue running even though alarm limits have been exceeded. The alarm outputs will either latch (continue) or automatically reset (turn off), depending on ALARM AUTO RESET switch position.

3. OPERATION

3.1. INFORMATION PROVIDED

This chapter shows and describes all switches and displays used for programmer operation, then provides step-by-step procedures for entering one program or several. Also included are instructions for program operation using either JCS controllers or external computers.

3.2. SWITCHES AND DISPLAYS

Figure 3-1, a photograph of the programmer front panel, assigns numerical keys to each switch and display on the panel. These numbers correspond to the reference numbers in Table 3-1, which summarizes the function and use of each item.

3.3. SWITCH-SELECTABLE FEATURES

Certain operating characteristics of both the standard Model 240 and programmers equipped with computer interfaces may be modified by changing DIP switch settings. See Chapter 2 for instructions on setting these switches.

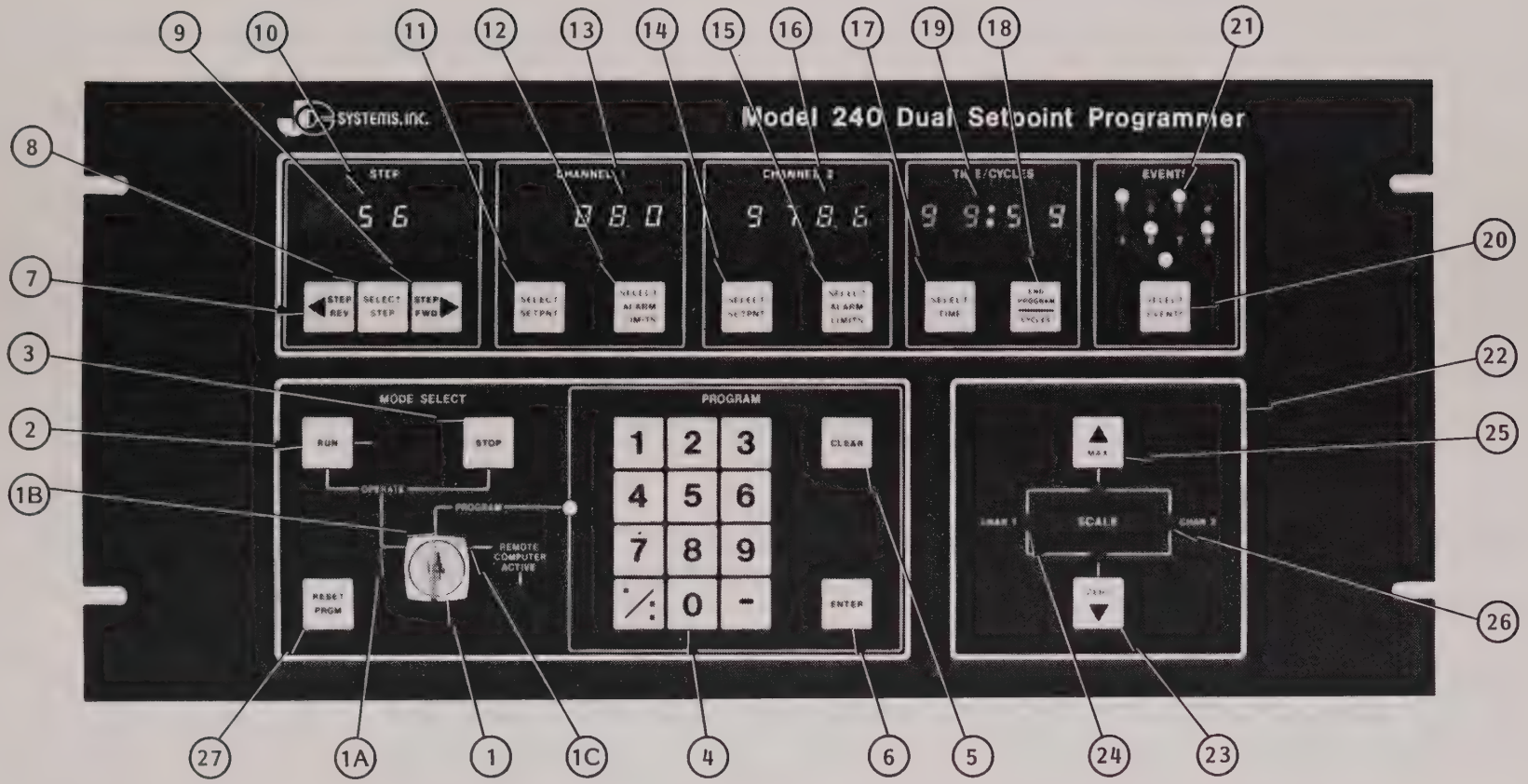


Figure 3-1. Key to Front Panel Switches and Displays.

TABLE 3-1. EXPLANATION OF FRONT PANEL SWITCHES AND DISPLAYS

ITEM	LEGEND	TYPE	DESCRIPTION
1	MODE SELECT	Keyswitch	Selects programmer mode by position as follows:
1A	OPERATE		Enables operation; used in conjunction with RUN and STOP switches (Items 2 and 3)
1B	PROGRAM	LED	Enables programming; LED to right of PROGRAM legend lights to signal that keyboard is active
1C	REMOTE COMPUTER ACTIVE		Enables remote computer to generate operating commands to the programmer
2	RUN	Switch with LED	With keyswitch in OPERATE mode, pressing the RUN switch lights its LED and begins program with current step. Current actual values are displayed; programmed setpoints can be viewed using STEP REV/FWD switches
3	STOP	Switch	With keyswitch in OPERATE mode, pressing STOP switch turns off RUN LED and freezes the program at current settings until the RUN switch is again pressed. Program parameters may be reviewed while in OPERATE-STOP mode using STEP REV/FWD switches.

TABLE 3-1. EXPLANATION OF FRONT PANEL SWITCHES AND DISPLAYS (Cont.)

4	PROGRAM	Keypad	Digits 0 thru 9 used to enter numerical values for program: units, time, limits. Dot or period (.) enters decimal point; colon (:) separates minutes:seconds or hours:minutes; minus (-) enters negative value (where allowed)
5	CLEAR	Switch	Clears previous program data (or incorrect entry)
6	ENTER	Switch	Stores data displayed for applicable parameter in program memory and automatically advances program pointer to next parameter -- ENTER switch **must** be pressed to store information in the program
7	STEP FWD	Switch	Not operable in OPERATE-RUN mode; advances program pointer in OPERATE-STOP mode; advances program step (counter) in PROGRAM mode.

NOTE: Both the STEP FWD and STEP REV switches cause the program counter/pointer to slew (move rapidly) when the switch is held down with moderate, steady pressure.

8	SELECT STEP	LED	In PROGRAM mode, lighted LED indicates that data is recorded in step currently displayed, and another step must be selected using the switches on either side
9	STEP REV	Switch	Not operable in OPERATE-RUN mode; moves program pointer back in OPERATE-STOP mode; moves program step (counter) back in PROGRAM mode. (See NOTE under Item 7, STEP FWD)

TABLE 3-1. EXPLANATION OF FRONT PANEL SWITCHES AND DISPLAYS (Cont.)

10	STEP	Display	Counts program steps (segments) and displays current (or selected) step number.

NOTE: The following instructions are common to all SELECT switches (Items 11, 12, 14, 15, 17, and 20) in the modes indicated.

1. In PROGRAM mode, the lighted LED above the SELECT switch acts as a program pointer to indicate that the parameter named on the switch is the next one to be entered.
2. In OPERATE-RUN mode, pushing a SELECT switch displays the programmed value (or events) for that parameter.
3. In OPERATE-STOP mode, the lighted LED above the SELECT switch acts as a program pointer to indicate which parameter has been selected. (Also see Items 7 and 9.)

11	SELECT SETPNT (Channel 1)	Switch with LED	With keyswitch in PROGRAM mode, LED lights to indicate when Channel 1 ready to receive setpoint data. (A step number that has no data must be selected before this LED will illuminate in PROGRAM mode.) Use keypad to enter setpoint (value -999.9 thru +999.9). Also see note following Item 10.
12	SELECT ALARM LIMITS (Channel 1)	Switch with LED	See note following Item 10. Use keypad to enter alarm limits (value 0.1 thru 999.9).

TABLE 3-1. EXPLANATION OF FRONT PANEL SWITCHES AND DISPLAYS (Cont.)

13	CHANNEL 1	Display	Displays the selected Channel 1 value as indicated by a lighted LED above either SELECT SETPNT or SELECT ALARM LIMITS switch and the current program mode (see note following Item 10).
14	SELECT SETPNT (Channel 2)	Switch with LED	Same as for Channel 1 (Item 11)
15	SELECT ALARM LIMITS (Channel 2)	Switch with LED	Same as for Channel 1 (Item 12)
16	CHANNEL 2	Display	Same as for Channel 1 (Item 13)
17	SELECT TIME	Switch with LED	See note following Item 10. Use keypad to enter segment duration (time from 0 minutes thru 99 hours, 59 minutes; switch-selectable to minutes and seconds).
18	END PROGRAM CYCLES	Switch with LED	In PROGRAM mode, pushing this switch automatically places the programmer into an end-of-program routine. LED will light and current number of programmed cycles (if any) will be displayed. Use keypad to enter or revise the programmed number of cycles (1 thru 9999). In OPERATE-RUN mode, pushing this switch displays the cycles remaining until end of program execution. In OPERATE-STOP mode, the current programmed value will be displayed when the switch LED is lighted.

TABLE 3-1. EXPLANATION OF FRONT PANEL SWITCHES AND DISPLAYS (Cont.)

19	TIME/ CYCLES	Display	Displays the selected value for either Item 17 or 18 as indicated by a lighted LED above either SELECT TIME or END PROGRAM|LIMITS switch and the current program mode (see note following Item 10).
20	SELECT EVENTS	Switch with LED	See note following Item 10. Use the keypad to select up to 8 events by number.
21	EVENTS	LED´s No. 1 thru 8	Lighted LED´s correspond to the event numbers that have selected for the current program.
22	SCALE	None	Area used for scaling 0-5V digital to analog output for analog controllers. Requires that D/A converters be installed. Refer to Para. 3.??? for detailed scaling procedure.
23	ZERO	Switch with LED	LED serves as program pointer to prompt entry of zero value for scaling. Use keypad to enter value.
24	MAX	Switch with LED	LED serves as program pointer to prompt entry of maximum value for scaling. Use keypad to enter value.
25	CHAN 1	LED	LED lights to prompt entry of scaling values for Channel 1, automatically goes out after entry.
26	CHAN 2	LED	LED lights to prompt entry of scaling values for Channel 2, automatically goes out after entry.
27	RESET	Switch	Resets current program to first step

TABLE 3-2. PROGRAMMING SUMMARY

STEP/REF PARA.	OPERATION/PARAMETER	DISPLAY LEGEND	PROG PTR LOCATION[1]	UNITS RANGE[2]	ADDITIONAL NOTES
3.4.1.1	Select starting step: Turn keyswitch (1) to PROGRAM setting	MODE SELECT	Channel 1 SELECT SETPNT (11)	1-91 Steps	Program counter must be on clear step
3.4.1.2	Enter Chan. 1 setpoint	CHANNEL 1 (13)	SELECT SETPNT (11)	-999.9 thru +999.9	
3.4.1.3	Enter Chan. 1 alarm limits	CHANNEL 1 (13)	SELECT ALARM LIMITS (12)	0.1 thru 999.9	
3.4.1.4	Enter Chan. 2 setpoint	CHANNEL 2 (16)	SELECT SETPNT (14)	-999.9 thru +999.9	
3.4.1.5	Enter Chan. 2 alarm limits	CHANNEL 2 (16)	SELECT ALARM LIMITS (15)	0.1 thru 999.9	
3.4.1.6	Enter time (segment duration)	TIME/CYCLES (19)	SELECT TIME (18)	0 min. thru 99 hrs. 59 min. std.	0 sec. thru 99 min. 59 sec. switch-selectable
3.4.1.7	Enter events	EVENTS LED´s (21)	SELECT EVENTS (20)	1 thru 8	Counter advances to next step, pointer to Chan. 1 SELECT SETPNT LED
3.4.1.8	Enter remaining steps: repeat 2 thru 7				
3.4.1.9	End program - enter cycles (Press END PROGRAM/CYCLES switch to enter)	TIME/CYCLES (19)	END PROGRAM/ CYCLES (18)	1 thru 9999	Counter moves to 1st step of program just entered

[1]To clear previously entered parameters, press CLEAR (5) and ENTER (6) switches.

[2]Input on keypad (4), then press ENTER switch (6) to store in memory. Unless otherwise noted, program pointer moves to next parameter.

3.4. PROGRAMMING

3.4.1. ENTERING A PROGRAM

To enter a new program, refer to Figure 3-1 and Table 3-1 and proceed as follows.

3.4.1.1. General Instructions

1. You will find it helpful to write out each step of the program to be entered on a Program Worksheet (see Appendix A.) This is especially helpful when using the CYCLES feature to reduce the number of steps required per program (see Para. 3.4.1.10).
2. Numbers in parentheses following switch or display names refer to item numbers in Figure 3-1 and Table 3-1.
3. Remember that the CLEAR switch (5) can be used at any time to remove incorrect input, and the ENTER switch (6) **must** be used to store input in memory.
4. After following the step-by-step procedures a few times, you may find it more convenient to use the Programming Summary, Table 3-2.

3.4.1.2. Special First Segment Features

The first step (segment) in any Model 240 program differs from all other steps because the starting temperature for the first step is always the current actual process temperature. (In other steps, the starting temperature is the same as the setpoint for the preceding step.) This feature permits interrupting a profile at any time and returning to ambient conditions at a controlled rate. Using this feature prevents thermal shock to the unit under test whenever it is necessary to abort the run. To take advantage of this feature, proceed as follows.

1. Determine the maximum deviation from ambient; for example, if the unit was to be cycled from -55 to +125°C and ambient was considered as 25°C, the maximum deviation would be 100.
2. Divide the deviation by the maximum permissible rate of temperature change in degrees C per minute; for example, 10°C/min. This yields the maximum permissible excursion time in minutes; in this example, 10 minutes. To summarize Steps 1 and 2:

   Max. (+ or -) temp minus ambient = deviation (125 - 25 = 100)

   $$\frac{\text{Deviation}}{\text{Max. Rate of Change}} = \text{Max. Excursion Time } (100 \div 10 = 10)$$

3. Therefore, program Step 1 with a specified setpoint of 25°C (ambient) and a specified duration of 10 minutes. Then, should it be necessary to abort the program at the maximum possible temperature, Step 1 will bring the temperature to ambient conditions at the permissible rate of temperature change. (The duration of Step 1 could be increased to provide an additional margin of safety if desired.)
4. During program operation (in OPERATE mode), press STOP to halt the program, then RESET to return to the first segment, and finally RUN to resume operation. The programmer will read the current actual process temperature from the controller as the segment starting temperature and ramp from there to the specified setpoint (25°C, ambient) over the specified duration (10 minutes). Once the system reaches ambient, press STOP to halt the program.

3.4.1.3. Select Starting Step

1. Insert key in keyswitch (1) and turn to PROGRAM mode (1B). PROGRAM LED lights and keypad becomes active.
2. If no programs have been entered, STEP (10) will display 1 for first step in first program. In this case, proceed to Step 3 of this procedure. Otherwise, use STEP FWD (9) or STEP REV (10) to move program counter to first available (unprogrammed) step.
3. Verify that LED above Channel 1 SELECT SETPNT switch (11) lights. This confirms that Channel 1 is clear to receive setpoint data.

3.4.1.4. Enter Channel 1 Setpoint

1. Using keypad (4), input desired value (-999.9 thru +999.9). Channel 1 display (13) will show inputted value.
2. Press ENTER (6) to record value in program memory and advance program pointer to next parameter.

3.4.1.5. Enter Channel 1 Alarm Limits

1. Using keypad (4), input desired value (0.1 thru 999.9). Channel 1 display (13) will show inputted value.
2. Press ENTER (6) to record value in program memory and advance program pointer to next parameter.

3.4.1.6. Enter Channel 2 Setpoint

NOTE

If Channel 2 will not be used, then each time the program pointer (LED) above Channel 2 SELECT SETPNT switch (14) lights, press CLEAR (5) and then ENTER (6). Note that this must be done for each step in the program.

1. Using keypad (4), input desired value (-999.9 thru +999.9). Channel 2 display (16) will show inputted value.
2. Press ENTER (6) to record value in program memory and advance program pointer to next parameter.

3.4.1.7. Enter Channel 2 Alarm Limits

1. Using keypad (4), input desired value (0.1 thru 999.9). Channel 2 display (16) will show inputted value.
2. Press ENTER (6) to record value in program memory and advance program pointer to next parameter.

3.4.1.8. Enter Time (Segment Duration)

1. Using keypad (4), input desired value (0 minutes thru 99 hours, 59 minutes in standard mode, or 0 seconds thru 99 minutes, 59 seconds in fast mode). Use colon to indicate minutes (or seconds, if minute/second mode has been selected). TIME/CYCLES display (19) will show inputted value.
2. Press ENTER (6) to record value in program memory and advance program pointer to next parameter.

3.4.1.9. Enter Selected Events

1. Using keypad (4), input the number of each desired event (as many as 8 events may be programmed). Corresponding EVENTS LED's (21) will light to show inputted selections.
2. Press ENTER (6) to record selected events in program memory. Step display (10) will advance to next step and program pointer will light over Channel 1 SELECT SETPNT (11).

3.4.1.10. Enter Parameters for Remaining Steps

Repeat Para. 3.4.1.2 thru 3.4.1.9 until parameters for all program steps have been stored in memory.

3.4.1.11. End Program

After all parameters for all steps of the program have been stored in memory, the program pointer will be lighted over Channel 1 SELECT SETPNT (11). Enter the End of Program (EOP) step as specified below.

NOTE

The CYCLES selection contained in the EOP step makes it possible to save programming space when a single run schedule contains a number of repetitive cycles. Group each of these into a single program segment, then program in the number of cycles with this step -- as many as 9999. (Using Appendix A, the Programmer Worksheet, will help you to identify opportunities for applying this feature.) The cycle will repeat as many times as necessary **without** using up valuable program memory.

1. Press END PROGRAM/CYCLES switch (18). Program pointer LED over switch will light.
2. Using keypad (4), input desired number of cycles (1 thru 9999). TIME/CYCLES display (19) will show inputted value.
3. Press ENTER (6) to record value in program memory. Program counter automatically moves to first step of program just entered.

3.4.2. STORING MULTIPLE PROGRAMS

3.4.2.1. Program Length

One complete program consists of all the steps programmed in the preceding paragraph, including the EOP step. A program with nine steps or segments is actually ten steps long (counting the EOP).

3.4.2.2. Programmer Memory Capacity

Since the Model 240 Programmer can store a maximum of 90 steps, it has room for nine programs each containing ten steps total (9 steps or segments plus the EOP step).

3.4.2.3. Importance of End-of-Program Step

The EOP not only signals the end of one program, it separates that program from the next one, and so **must** be included in every program. [Even if you don't plan to enter another program right away, someone else may -- or you may forget that you didn't end the first one correctly (with an EOP step) and write over it, making both programs incorrect.]

3.4.3. SCALING

If 0-5V D/A converters are installed and will be used to generate analog output, use the programmer front panel SCALE portion (22) to adjust the output as follows.

1. Press ZERO switch (23). ZERO switch and CHAN 1 display (24) LED's light and Channel 1 display (13, top row of programmer displays) shows the current scale value that will produce **zero** volts on the D/A converter. If no value has been entered, display will show a row of dashes (------). To clear a display value of a previously scaled value, press CLEAR (5) and ENTER (6) switches in that order.
2. Using keypad (4), input desired **zero** engineering value (any signed four-digit number, -999.9 or greater.) Channel 1 display (13) will show inputted value.
3. Press ENTER (6) to record value. ZERO switch LED goes out and MAX switch (25) LED lights. Channel 1 display (13, top row of programmer displays) now shows the currently programmed value that will produce **five** volts on the D/A converter.
4. Using keypad (4), input desired **maximum** engineering value (any signed four-digit number, +999.9 or less.) Channel 1 display (13) will show inputted value.
5. Press ENTER (6) to record value. MAX switch LED goes out; ZERO switch (23) and CHAN 2 LED's light. Channel 2 display (16, top row of programmer displays) now shows the currently programmed value that will produce **zero** volts on the D/A converter for Channel 2.
6. Using keypad (4), input desired **zero** engineering value (any signed four-digit number, -999.9 or greater.) Channel 2 display (16) will show inputted value.
7. Press ENTER (6) to record value. ZERO switch LED goes out and MAX switch (25) LED lights. Channel 2 display now shows the currently programmed value that will produce **five** volts on the D/A converter.
8. Using keypad (4), input desired **maximum** engineering value (any signed four-digit number, +999.9 or less.) Channel 2 display (16) will show inputted value.
9. Press ENTER (6) to record value, then press Channel 2 SELECT SETPNT switch (14) to end scaling. Programmer is now ready to produce correctly scaled analog output.

3.5. OPERATION

3.5.1. DIRECT PROGRAMMER OPERATION

This section describes operating modes where all commands originate from the programmer front panel. No computer or external control signals are used, and the MODE SELECT keyswitch (1) is in OPERATE mode position (1A).

3.5.1.1. OPERATE-RUN Mode

With the MODE SELECT keyswitch (1) in OPERATE mode position (1A), push RUN switch (2) to start program operation; RUN switch LED will light and the colon on the TIME/CYCLES display (19) will flash to show that program is running. The following displays are active under the conditions noted.

1. While programmer is running, current STEP (10) number, CHANNEL 1 and 2 setpoints (13 and 16), actual time remaining (TIME/CYCLES, 19), and EVENTS status (21) are simultaneously displayed without operator intervention.
2. In this mode, the operator can review programmed values as follows:
   a. Channel 1 and 2 programmed setpoints on respective channel displays (13 or 16) by pressing the applicable SELECT SETPNT switch (11 or 14).
   b. Total segment duration on TIME/CYCLES display (19) by pressing SELECT TIME switch (17).
   c. Remaining cycles (including the one in process) to end of program execution on TIME/CYCLES display (19) by pressing END PROGRAM/CYCLES switch (18).

3.5.1.2. OPERATE-STOP Mode

With the MODE SELECT keyswitch (1) in OPERATE mode position (1A), push STOP switch (3) to stop program operation; RUN switch LED will go out and the colon on the TIME/CYCLES display (19) will stop flashing to show that program was interrupted. Program will freeze at present conditions and hold there until the RUN switch (2) is pressed to resume programmer operation. No displays are active in the OPERATE-STOP mode, but program parameters can be reviewed as follows.

NOTE

You may **review** any program in memory while in this mode. However, you must turn the keyswitch to the PROGRAM mode before you can select a **different** program to run.

1. Use STEP REV or STEP FWD switches (7 or 9) to move program pointer to desired parameter as indicated by lighted LED above corresponding SELECT switch.
2. Press corresponding SELECT switch to read value (or events) in display above: SETPNT, Channel 1 or 2 (11 or 14); ALARM LIMITS, Channel 1 or 2 (12 or 15); TIME (17), and EVENTS (21).

3.5.2. EXTERNAL OPERATION

This section describes operating modes where some or all commands may originated from a remote signal source, such as a computer. Instructions for making required connections, DIP switch settings, and other details of interface to computers or other external control sources are contained in Chapter 2. Allowable commands and queries, which vary with the type of interface and the operational mode selected, are described below.

3.5.2.1. External Control Inputs

The programmer accepts externally generated inputs for program Run, Stop, and Reset. These are photo-coupled inputs that require a source voltage connection as explained in Chapter 2. The external connection is made at Events/Alarm Interface J6.

3.5.2.2. Computer Access -- OPERATE-RUN Mode

With the keyswitch in the OPERATE Mode, a remote computer can use either the IEEE-488 or the serial interface (depending on the option installed) to access the current status of a program. As shown in Table 3-3, the user enters a command code at the computer keyboard and the current value or parameter is displayed on the computer CRT. Depending on the type of interface, different formats are required before the programmer will respond to these codes as follows.

a. Standard RS-232, RS-232/RS-422, or IEEE-488 (One Model 240 Programmer interfaced with one computer) -- type as shown in Table 3-3; no special formatting required.

b. RS-232C/RS-422A or IEEE-488 (One or more Model 240's interfaced with one computer via either RS-422 or IEEE-488 party line) -- before entering command code, type the number symbol (#) followed by the address number assigned to the programmer (1 to 99, user-selected by direct-reading switches on the rear panel). There must be a blank space between the address number and the command. (See Figure 3-2.)

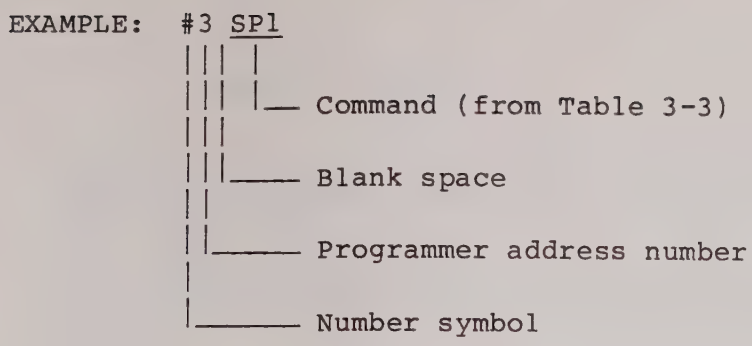


Figure 3-2. Format for Remote Computer Commands (more than one Model 240 on line)

TABLE 3-3. COMPUTER ACCESS COMMANDS FOR OPERATE-RUN MODE

CODE	READS
SP1	Channel 1 current setpoint value
SP2	Channel 2 current setpoint value
PR1	Current actual Channel 1 process variable (such as temperature)
PR2	Current actual Channel 2 process variable
TIM	Time remaining until completion of current step
STN	Current step number from program counter
CTG	Number of cycles remaining in current program (including current cycle)
DIP	DIP switch settings for switch Z33 on A1546
LCK	Keyswitch position - operate (OPR), program (PRG), or remote (RMT)
MOD	Operating mode [returns run (RUN), stop (STP), or end of program (EOP)]
?	Program parameter last queried and advances program pointer. One of the above three modes (RUN, STP, or EOP) must be selected before this command will function. Reading cycles resets the pointer. Reading the last step returns EOP.
ALM	Alarm conditions -- L1 = Channel 1 limit exceeded L2 = Channel 2 limit exceeded S1 = Controller 1 failure S2 = Controller 2 Failure

TABLE 3-3 (Cont.)

SST	Program Counter to display or change current step
SCY	End Program/Cycles to display or change cycles and enter EOP step
SSC	Scaling to display or change zero/maximum values when D/A converter installed to generate scaled analog output
*RQN	Service Request Enable
*RQD	Service Request Disable

* Active only with IEEE-488 option. When installed as described in Chapter 2, the service request capability can generate an interrupt whenever the alarm status for either channel changes. These commands turn that capability on and off.

3.5.2.3. REMOTE COMPUTER ACTIVE Mode

In this mode, the programmer front panel controls are inactive; all programmer operations are controlled by commands from the interfaced computer. In addition to the OPERATE mode commands listed in Table 3-3, the following direct operational commands are accepted by the programmer in REMOTE COMPUTER ACTIVE mode.

Table 3-4: COMPUTER COMMANDS FOR REMOTE COMPUTER ACTIVE MODE

CODE	TRANSMITS
RUN	Run command - same as pushing RUN button
STP	Stop command - same as pushing STOP button
PRR	Reset command - resets current program to its first step
!	Enter command - enters data for parameter identified by program pointer (last selected display) -- same as pushing ENTER button
CLR	Clear command - clears data for parameter identified by program pointer (last selected display) -- same as pushing CLEAR button
ULD	Upload command - sends total program data as stored in memory (up to 2050 characters) out via computer interface with an ASCII Code ":" as the start-of-file character and a "/" as the end-of-file character.
DLD	Download command - accepts data in the same format that was produced as a result of the ULD (upload) command and loads programmer memory with all information previously uploaded to the computer. Accepts up to 2050 characters; spaces ( ) and carriage returns <CR> are not counted in total.

Table 3-4 (Cont.)

CODE	TRANSMITS
SST	Program Counter to display or change current step
SCY	End Program/Cycles to display or change cycles and enter EOP step
SSC	Scaling to display or change zero/maximum values when D/A converter installed to generate scaled analog output

4. MAINTENANCE

4.1. DIGITAL/ANALOG CONVERTER CALIBRATION

The A1623 digital-to-analog converter is factory set for operation at either 0 to 5 Vdc or 0 to 10 Vdc. To calibrate converter output, proceed as follows.

1. Using a voltmeter or multimeter, monitor output voltages at TP1 (positive output) and TP2 (ground) on the A1623 printed circuit board to verify nominal setting and need for calibration.
2. Enter sample program shown in Table 4-1. This program sets D/A output at 0% for 10 seconds (on min/sec programmer), then at 100% for 10 seconds, looping through (repeating) the two steps 10 times.

NOTE

If programmer timing is set for hours/minutes, use 00:01 as the time for steps and run for 5 cycles instead of 10.

TABLE 4-1: PROGRAM FOR CALIBRATING D/A CONVERTER

Step	Setpoint #1	Setpoint #2	Time (min/sec)	Cycles
1	0	0	00:10	--
2	100	100	00:10	--
EOP				10

3. Run program and calibrate D/A converter.
   a. During Step 1, adjust potentiometer R10, OFFSET, for 0 ±0.0001 Vdc.
   b. During Step 2, adjust potentiometer R2, FULL SCALE, for 5 ±0.0001 Vdc if the converter was set to 0-5V range, or 10 ±0.0001 Vdc if the converter was set to 0-10V range.
4. Rerun program, monitoring output at TP1 to ensure there is no offset when the output changes from minimum to maximum.

4.2. PROGRAMMER TEST PROCEDURE

4.2.1. POWER-UP AND THRESHOLD TEST

1. Using an ohmmeter, check for shorts between ground and +5V, +9V, and +5V pulsed. All values should be greater than 100 ohms.
2. Connect Variac set for 117Vac RMS.
3. Plug in programmer to Variac and use voltmeter to check voltage readings: +5V should be 4.91 to 5.15V; +9V should be 8.3 to 11V; +5 pulsed should be 2.5 to 3.9V.
4. Connect an oscilloscope set to 2V per division to TP3 on logic control board A1550. Adjust Variac for 85 ±1Vac RMS, then adjust POWER FAIL threshold resistor R24 until pulses just appear on scope. Pulses should disappear when Variac voltage increases and reappear when it decreases.
5. Remove scope from TP3, remove Variac, and restore normal power to programmer.

4.2.2. FRONT PANEL SWITCH AND DISPLAY TEST

1. Set keyswitch to program mode and press SELECT STEP switch. SELECT STEP LED should light. If STEP display doesn't show the number 1, press 1 on keypad, then ENTER switch; STEP display should now show 1.
2. Press and hold down STEP FWD switch. STEP display should slew (move rapidly) from 2 to 91. Verify that all step numbers light and are uniformly bright.
3. Press and hold down STEP REV switch. STEP display should slew from 91 back to 1. Press SELECT STEP, 1 on keypad and ENTER; program pointer LED should light above Channel 1 SELECT SETPNT switch.
4. Press Channel 1 SELECT SETPNT switch, then press numbers on keypad (1...2...3...4...etc.). Numbers on display should shift left from the decimal point. Press decimal point and numbers again; numbers should shift right from decimal point.
5. Press keypad 1 and hold for 1/2 second; it should not auto-repeat.
6. Repeat Steps 4 and 5 with each parameter switch and display.
7. Press SCALE ZERO switch and verify that ZERO and CHAN 1 LED's light. Press switch again and verify that ZERO and CHAN 2 LED's light.
8. Press SCALE MAX switch and verify that MAX LED lights. Press MAX switch repeatedly and verify that switch toggles CHAN 1 and CHAN 2 LED's on and off.
9. Press SCALE ZERO switch and verify that ZERO LED lights. Press ZERO switch repeatedly and verify that switch toggles CHAN 1 and CHAN 2 LED's on and off.

APPENDIX A. MODEL 240 PROFILE WORKSHEET

JC SYSTEMS INC. PROGRAM NO. _____ DATE: _____

STEP	CHANNEL 1		CHANNEL 2			EVENTS							
NO.	SETPNT	ALM LMT	SETPNT	ALM LMT	TIME	1	2	3	4	5	6	7	8
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													

NOTES:
1. Each separate program must be terminated with an END OF PROGRAM (EOP) step to separate it from the ones before and after.
2. Multiple programs can be stored and individually executed -- select first step of desired program
3. If programmer equipped with analog output option, be sure to scale the appropriate channel for analog output

STEP NO.	CHANNEL 1 SETPNT	CHANNEL 1 ALM LMT	CHANNEL 2 SETPNT	CHANNEL 2 ALM LMT	TIME	EVENTS 1	2	3	4	5	6	7	8
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													
41													
42													
43													
44													
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65													

NOTES:
1. Each separate program must be terminated with an END OF PROGRAM (EOP) step to separate it from the ones before and after.
2. Multiple programs can be stored and individually executed -- select first step of desired program
3. If programmer equipped with analog output option, be sure to scale the appropriate channel for analog output

STEP NO.	CHANNEL 1 SETPNT	CHANNEL 1 ALM LMT	CHANNEL 2 SETPNT	CHANNEL 2 ALM LMT	TIME	EVENTS 1	2	3	4	5	6	7	8
66													
67													
68													
69													
70													
71													
72													
73													
74													
75													
76													
77													
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93													
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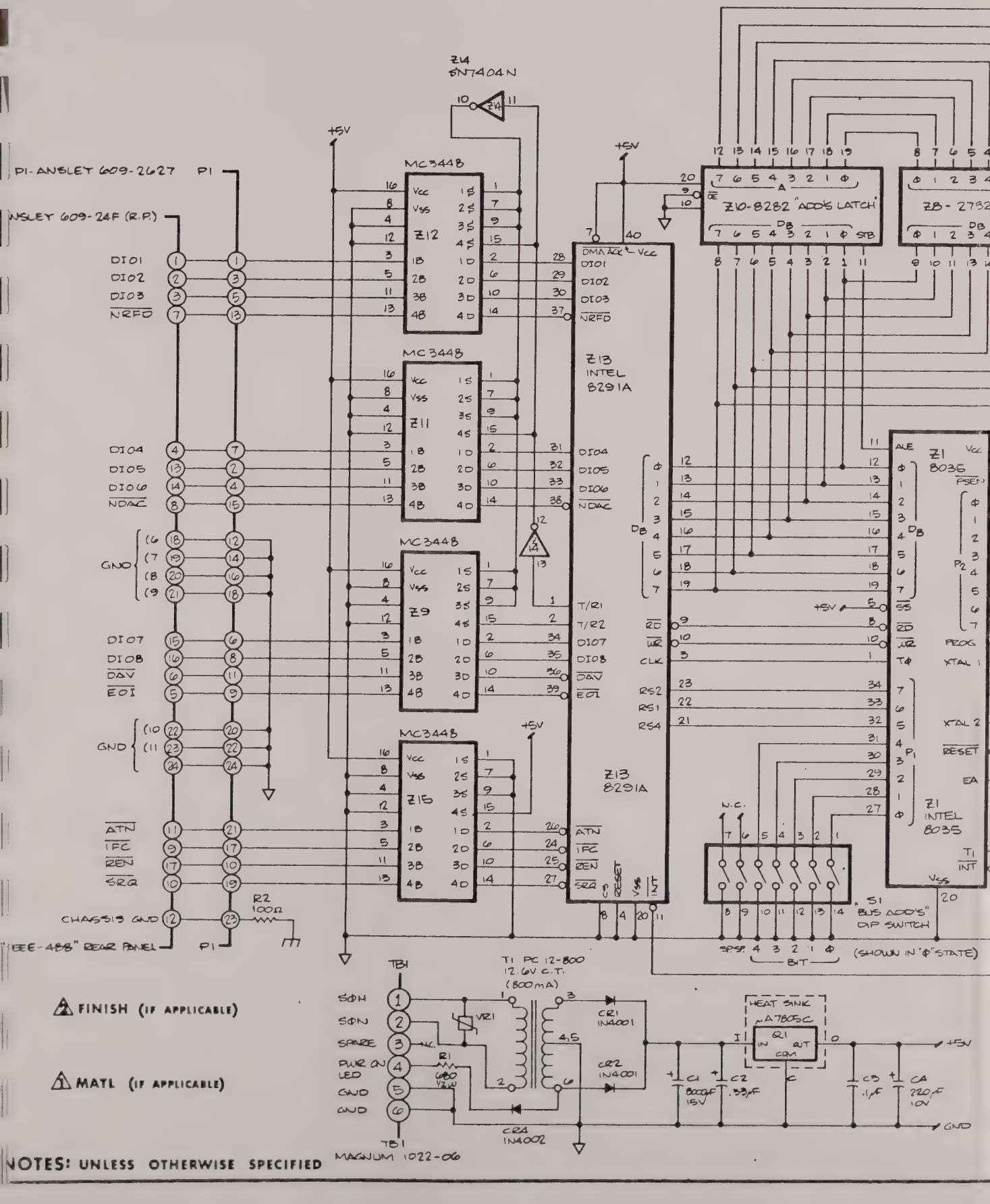
95													
96													
97													
98													
99													

NOTES:
1. Each separate program must be terminated with an END OF PROGRAM (EOP) step to separate it from the ones before and after.
2. Multiple programs can be stored and individually executed -- select first step of desired program
3. If programmer equipped with analog output option, be sure to scale the appropriate channel for analog output


Z14 SN7404N
P1-ANSLEY 609-2627 P1
NSLEY 609-24F (R.P.)
MC3448
Z12
Z11
Z9
Z15
DIO1
DIO2
DIO3
NRFD
DIO4
DIO5
DIO6
NDAC
GND
DIO7
DIO8
DAV
EOI
ATN
IFC
REN
SRQ
CHASSIS GND
R2 100Ω
"IEE-488" REAR PANEL
+5V
Z13 INTEL 8291A
DMA ACK
Vcc
T/R1
T/R2
RD
WR
CLK
RS2
RS1
RS4
RESET
CS
Vss
Z10-8282 "ADD'S LATCH"
STB
Z1 8035
ALE
PSEN
PROG
XTAL 1
XTAL 2
RESET
EA
INT
N.C.
S1 BUS ADD'S" DIP SWITCH
SPSP
BIT
(SHOWN IN "Φ" STATE)
TB1
SΦH
SΦN
SPARE
PWR ON LED
GND
MAGNUM 1022-06
T1 PC 12-800 12.6V C.T. (800mA)
VR1
R1 680 1/2W
CR1 IN4001
CR2 IN4001
CR4 IN4002
HEAT SINK
μA7805C
C1 8000μF 15V
C2 .33μF
C3 .1μF
C4 220μF 10V
+5V
GND
⚠2 FINISH (IF APPLICABLE)
⚠1 MATL (IF APPLICABLE)
NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV		
APPLICATION				EFFECTIVITY				

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0°30'

HOLE TOLERANCES

.013 THRU .139	+.004 −.001	.251 THRU .500	+.004 −.001
.156 THRU .500	+.004 −.001	.501 THRU .750	+.008 −.001

MATERIAL ⚠1
FINISH ⚠2

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC
DRAFTED	" 19 JAN 1983
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

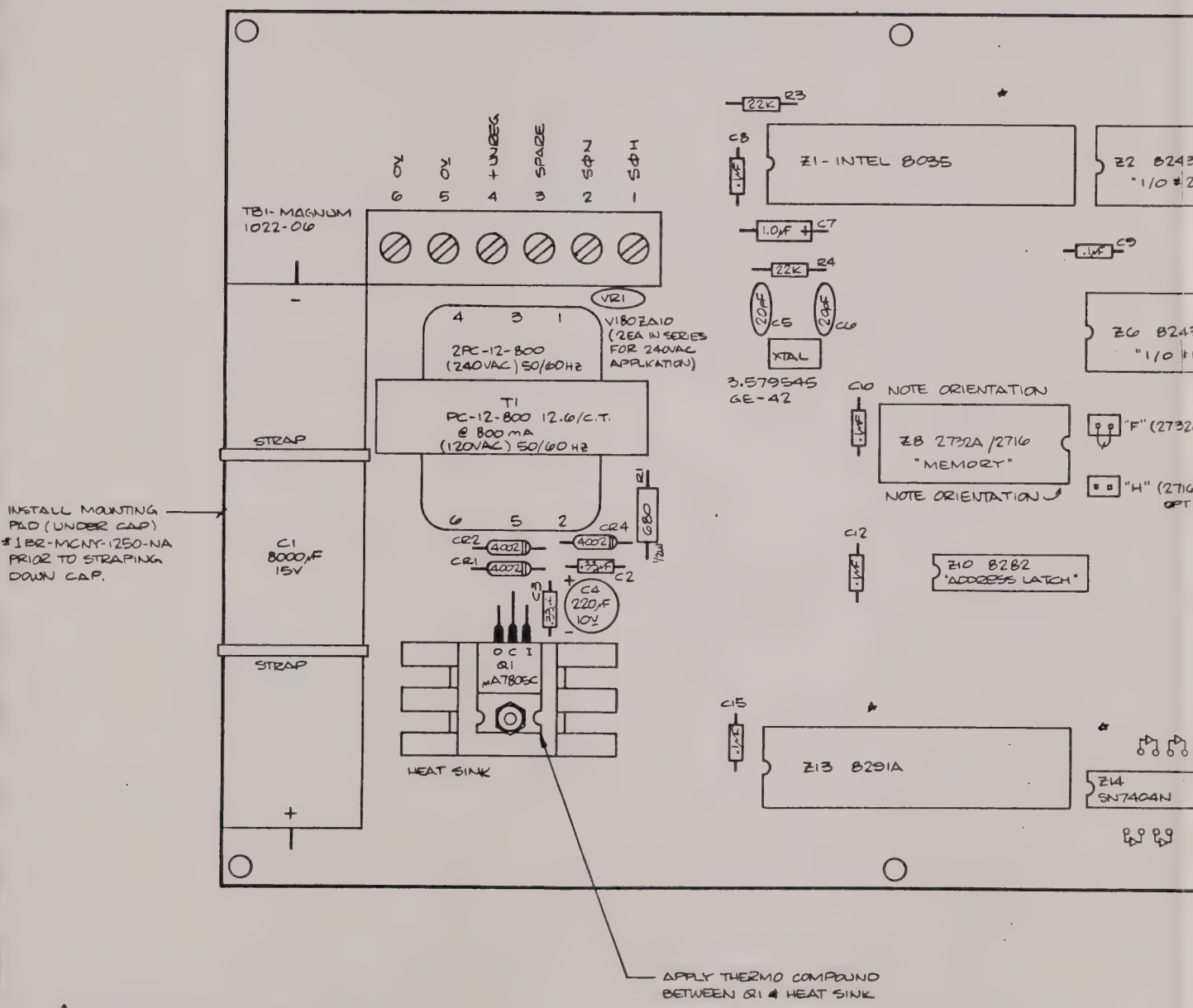
JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD SCH- IEEE-488 4 DECADE BCD INTERFACE MODEL A1538/1038

SIZE	CODE IDENT		
D		1537/1037	B

SCALE N.A.

SHEET 1 OF 1



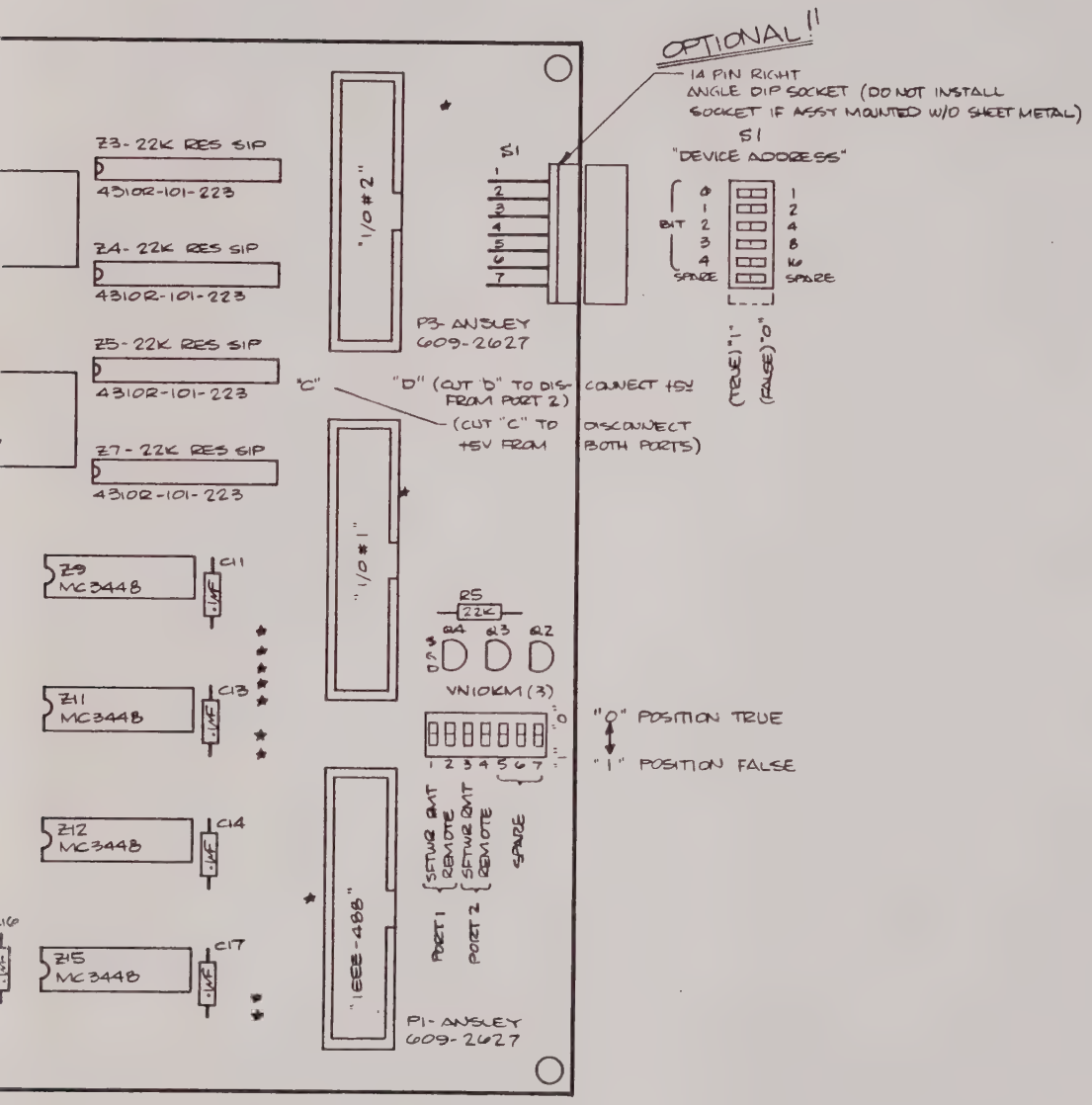
5. INSTALL JUMPER 'E' FOR 8748 AND OMITT 8282 (Z10) & 2716/2732A (Z8).

2. FINISH (IF APPLICABLE)

1. MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	MOVED R1 (1/4") TOWARD BD EDGE. ADDED R2, R2, R3, R4 & R5 * PROTO CORRECTIONS	10-21-83	
	B	INSTALL JUMPER "F" FOR 2732A PART NO.	1-21-85	



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DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03; .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES

.013 THRU .125	+.006 -.001	.281 THRU .500	+.006 -.001
.126 THRU .280	+.006 -.001	.501 THRU .750	+.006 -.001

MATERIAL ⚠1
FINISH ⚠2

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC
DRAFTED	26 JAN 1983
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

JC SYSTEMS, INC.

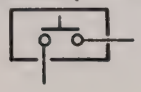
TITLE: PRINTED CIRCUIT BD ASSY - IEEE-488 & DECADE BCD INTERFACE MODEL A1538/1038

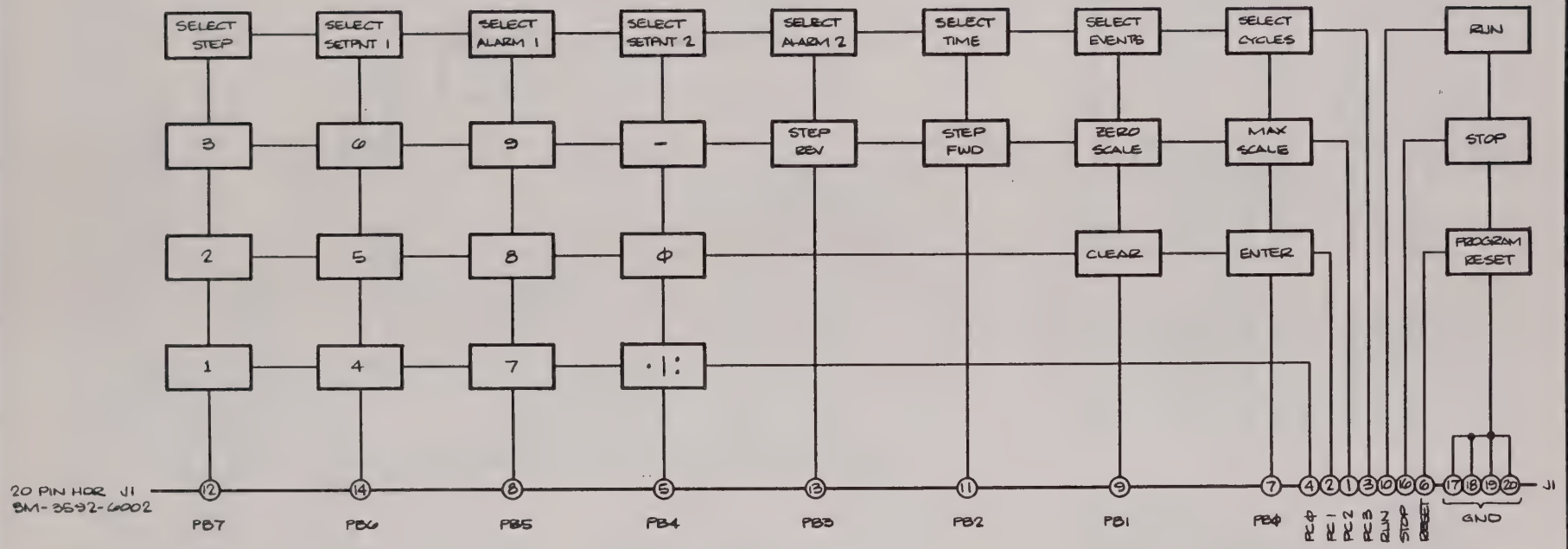
SIZE	CODE IDENT		
D		1538/1038	B

SCALE 2:1
SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD

KV DENVER DOME SW.
#SAS-50 (TYP 25)





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DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'

HOLE TOLERANCES
.013 THRU .125 +.004 -.001
.126 THRU .250 +.005 -.001
.251 THRU .500 +.006 -.001
.501 THRU .750 +.008 -.001

MATERIAL ⚠1
FINISH ⚠2

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	23MAY1983
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

JC SYSTEMS, INC. SAN DIEGO, CALIFORNIA

TITLE: PRINTED CIRCUIT BD. SCH — FRONT PANEL SWITCH BD. MODEL A1642

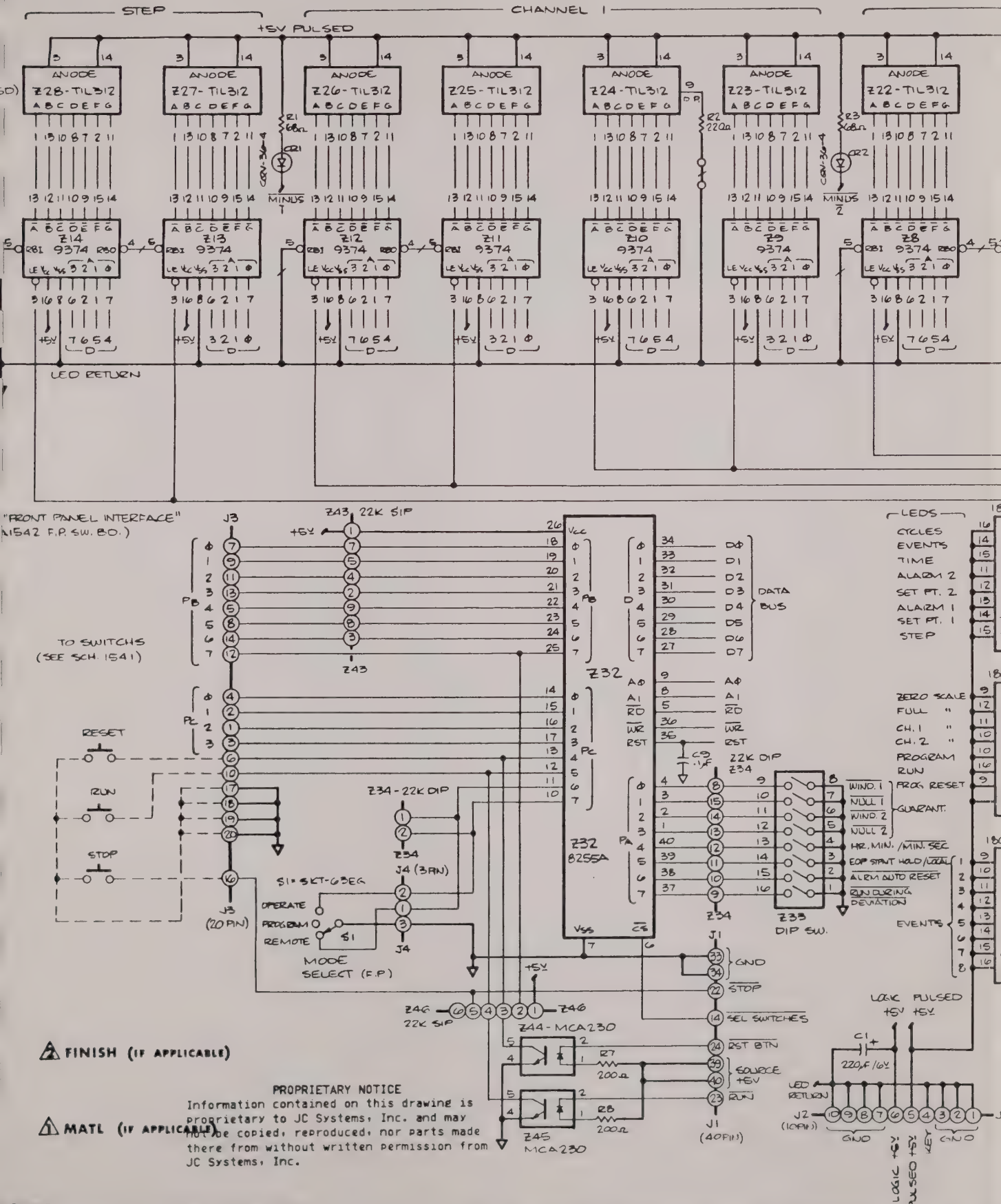
SIZE	CODE IDENT	
C		1541

SCALE N.A. SHEET 1 OF 1

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED



⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

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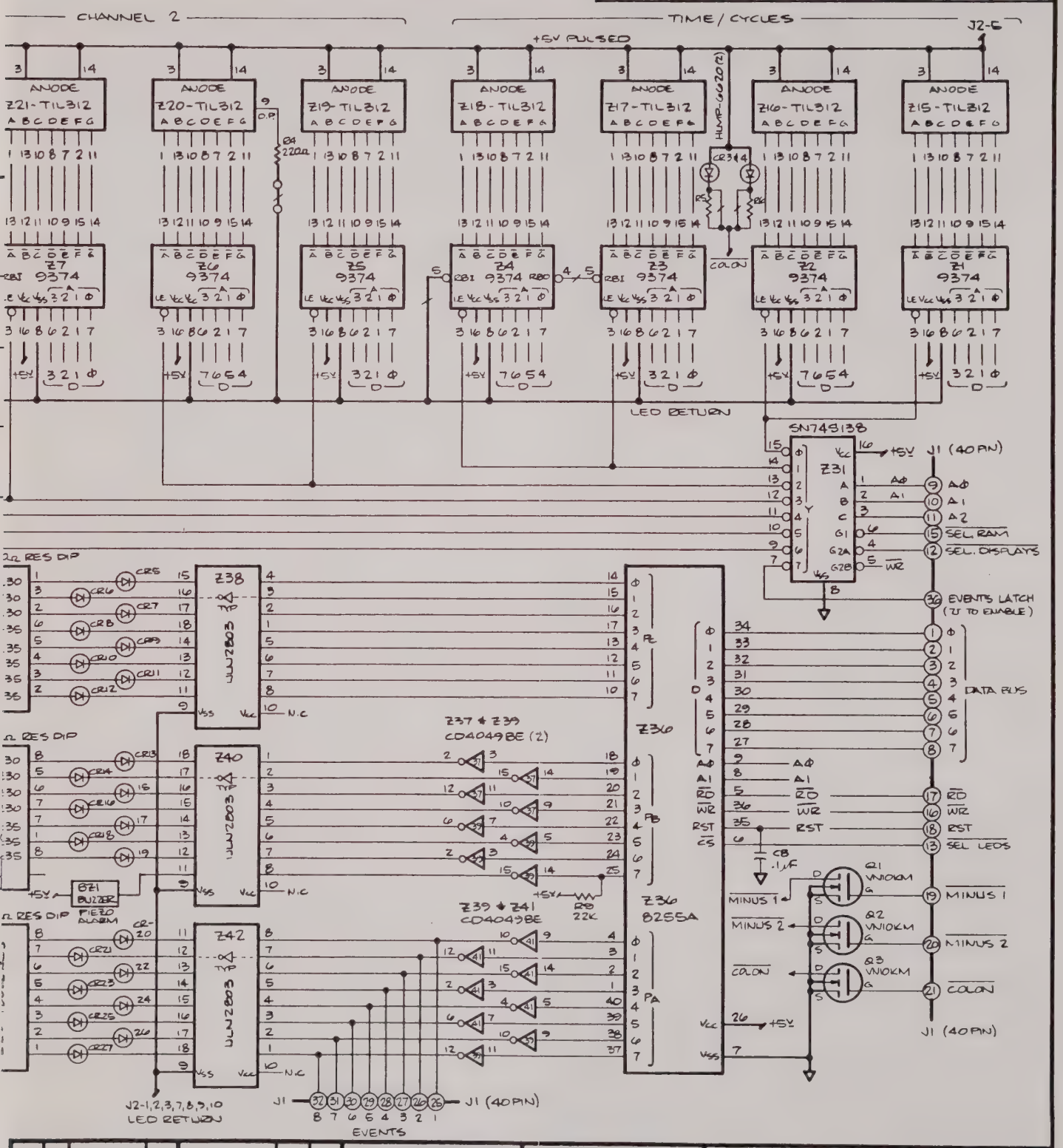
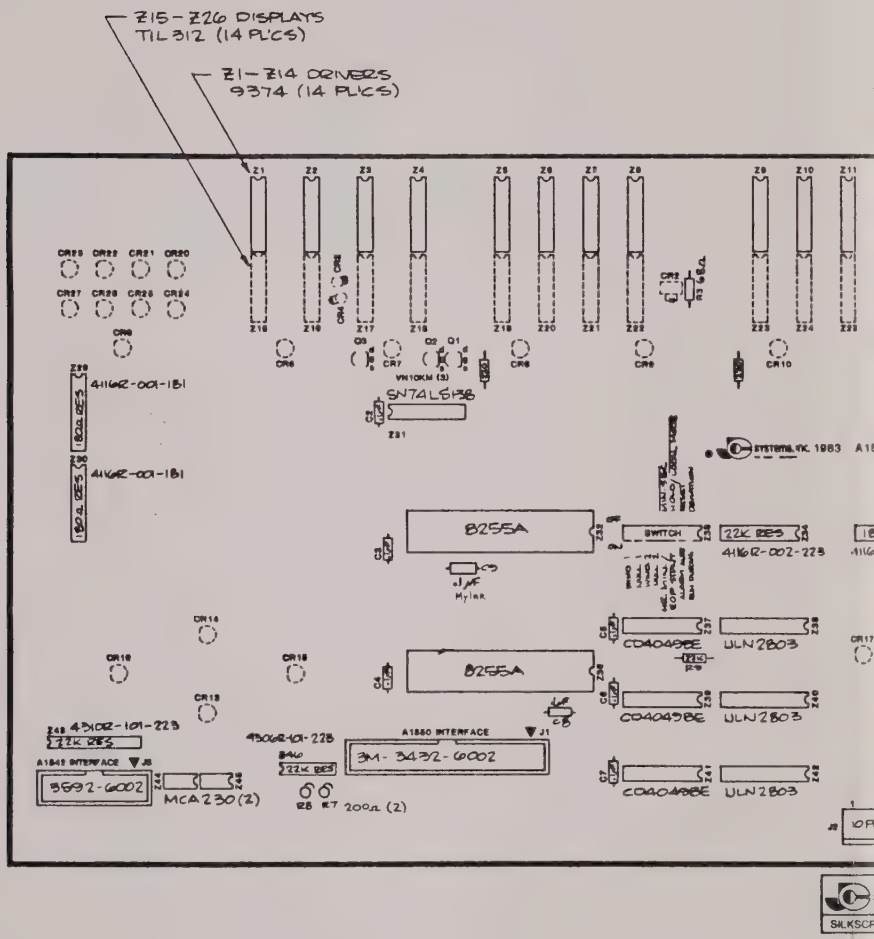
NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD



| | | | |



⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

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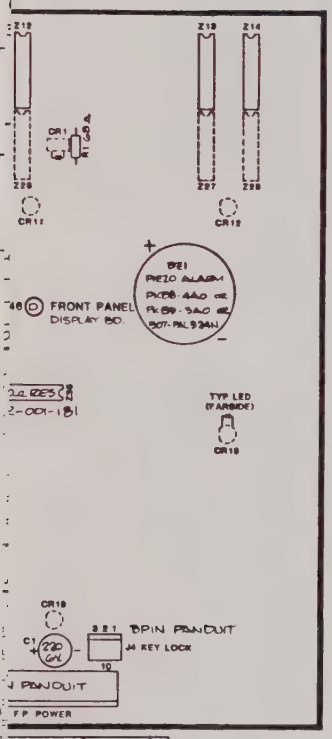
NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	REVISED PER PROTO EVALUATION; ADDED: R9, BZ1 (BUZZER)	7-22-83	
	B	ADDED CB-.001μF; R1 & R3 WAS FIX.; REVISED Z38 (DIP SW.); SWITCHED POSITION OF R7, R8, Z46	11-3-83	
	C	CB- WAS .001μF AND DID TIE TO +5V - CHNGD	1-21-85	
	D	ADDED C9, .1μF; CB WAS .01 MYLAR	3-7-85	



8 PIN PINOUT
4 KEY LOCK

SYSTEMS, INC.	NO 1547	D
	DATE 04/08/82	
EN	SHT 4 OF 4	

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL ⚠	
APPLICATION				EFFECTIVITY			FINISH ⚠	

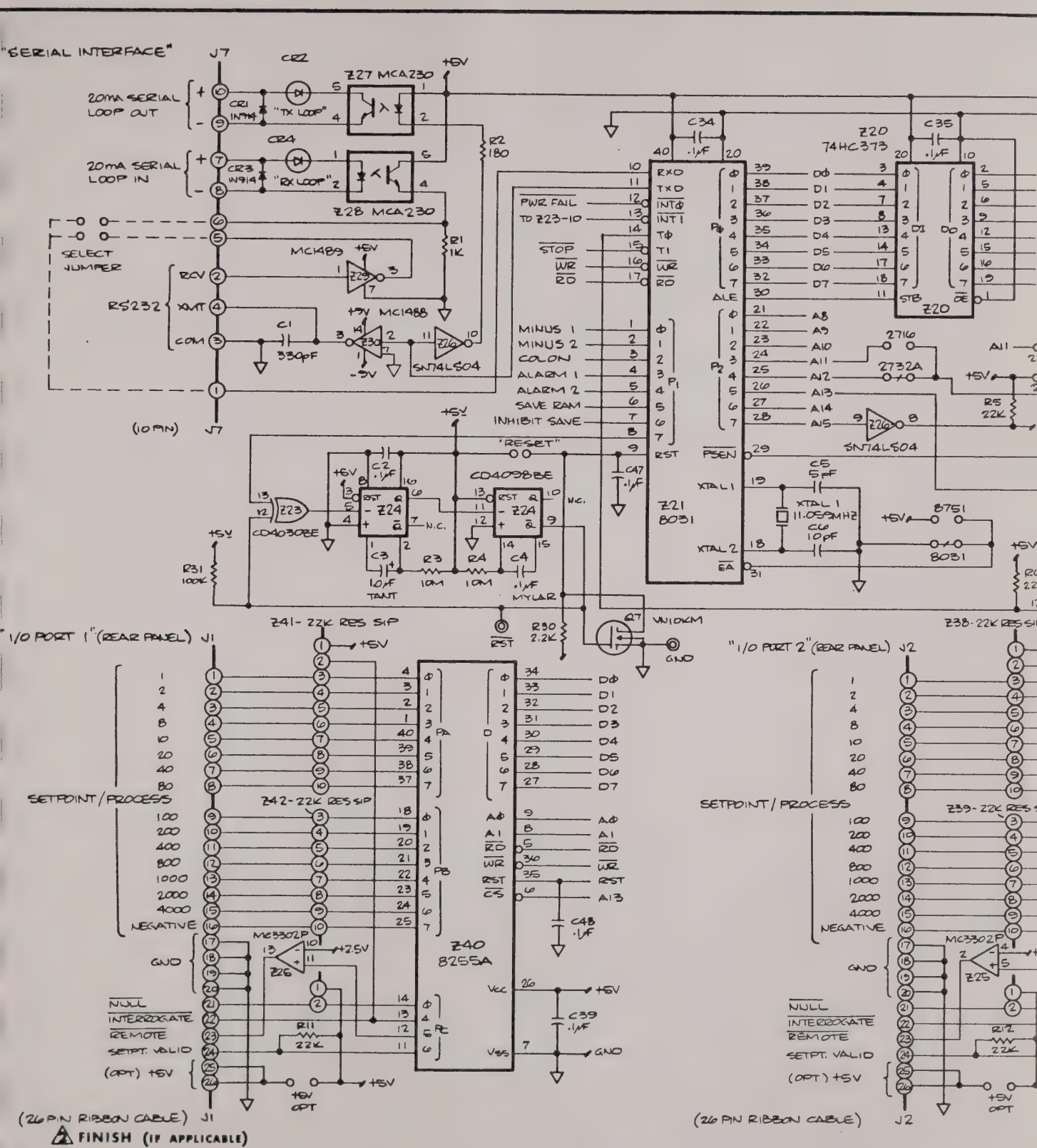
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03; .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES

ENGINEERING ACTIVITY	
DESIGN	VC SYSTEMS INC
DRAFTED	" 27 JUNE 1983
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

SYSTEMS, INC.

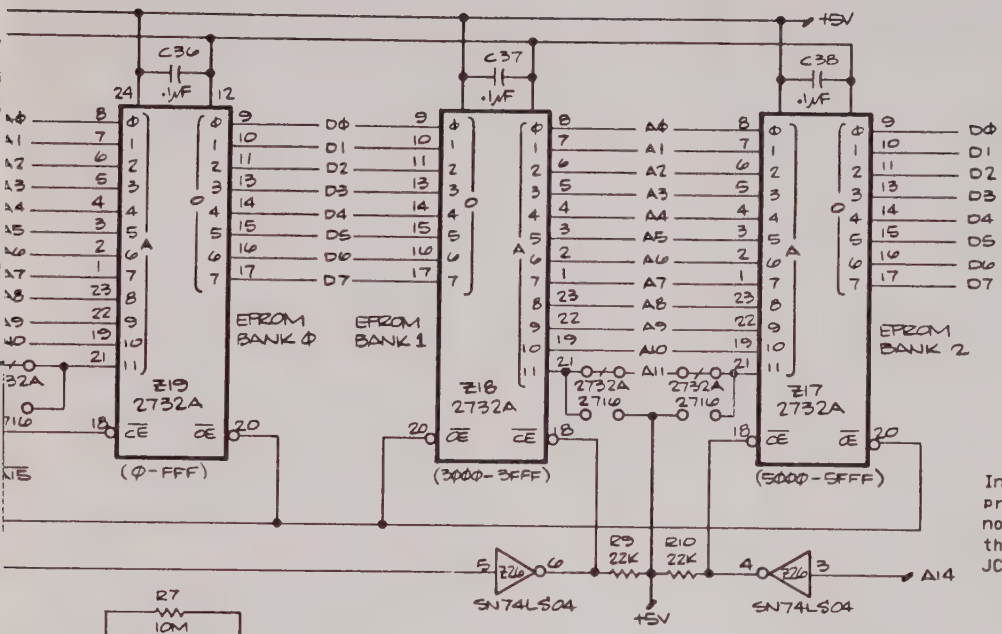
TITLE: PRINTED CIRCUIT BD. ASSY - FRONT PANEL DISPLAY BD. MODEL A1546

SIZE	CODE IDENT		
D		1546	D
SCALE FULL			SHEET 1 OF 1



NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
		SEE ASST A1550		



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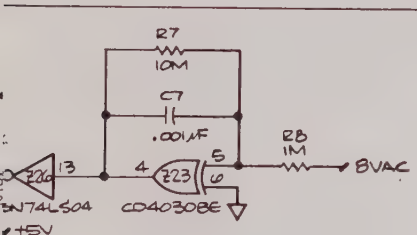
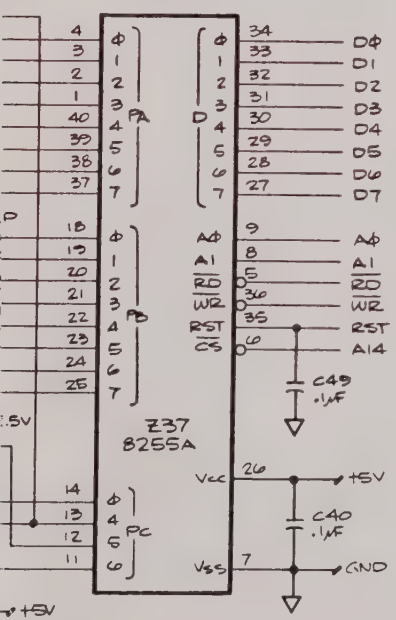
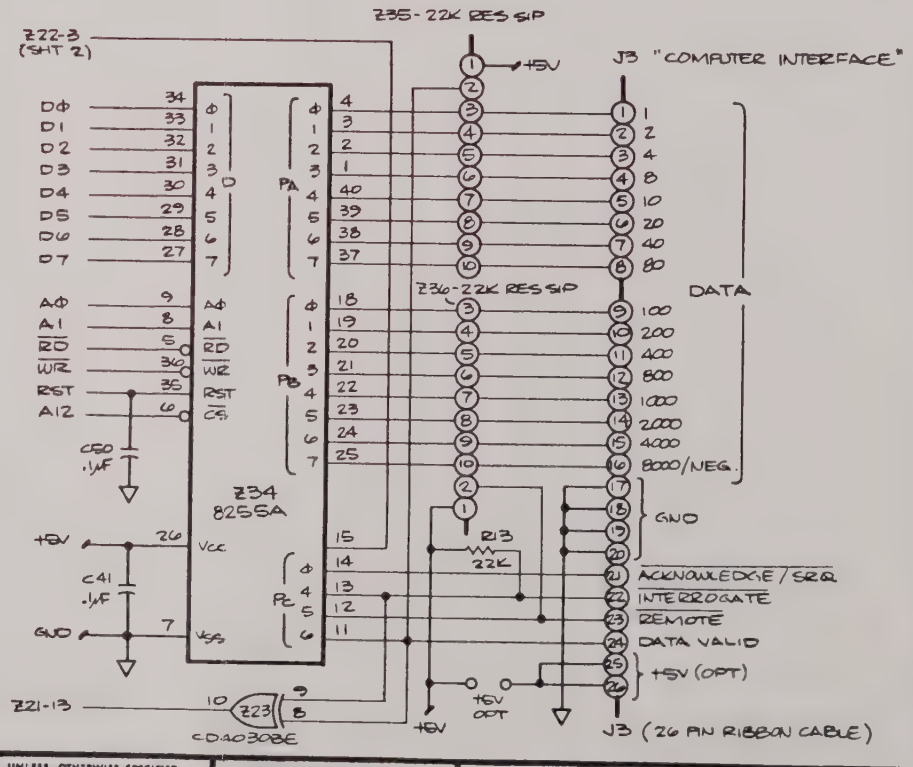






DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL ⚠1		
APPLICATION				EFFECTIVITY			FINISH ⚠2		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 6' 30'
MOST TOLERANCES
.013 THRU .125 +.005 -.001
.251 THRU .500 +.005 -.001
.126 THRU .250 +.005 -.001
.501 THRU .750 +.005 -.001

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC.
DRAFTED	" 03 JUNE 1983
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

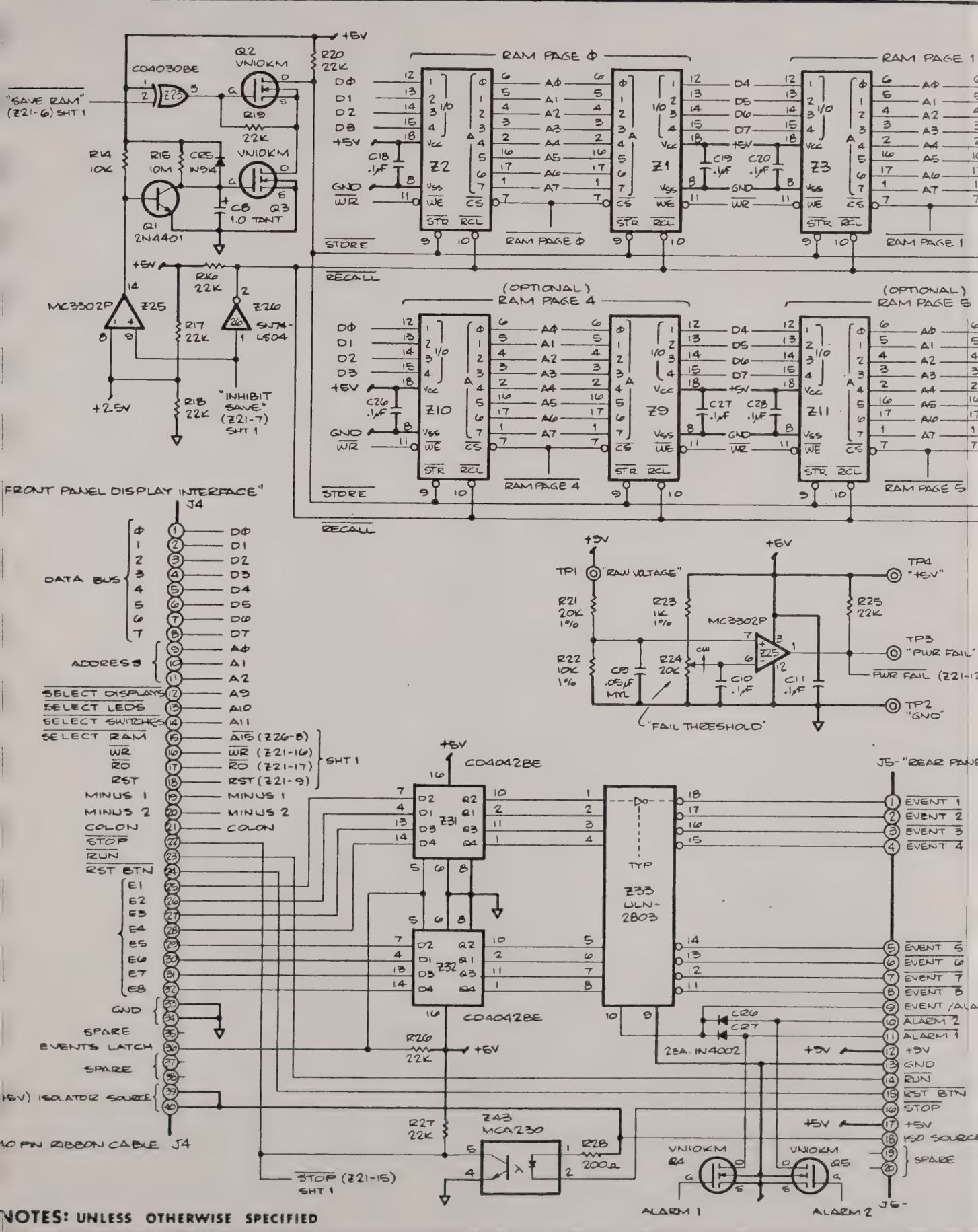
JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD SCH — CONTROL LOGIC BD MODEL A1550

SIZE	CODE IDENT		
D		1549	C

SCALE N/A

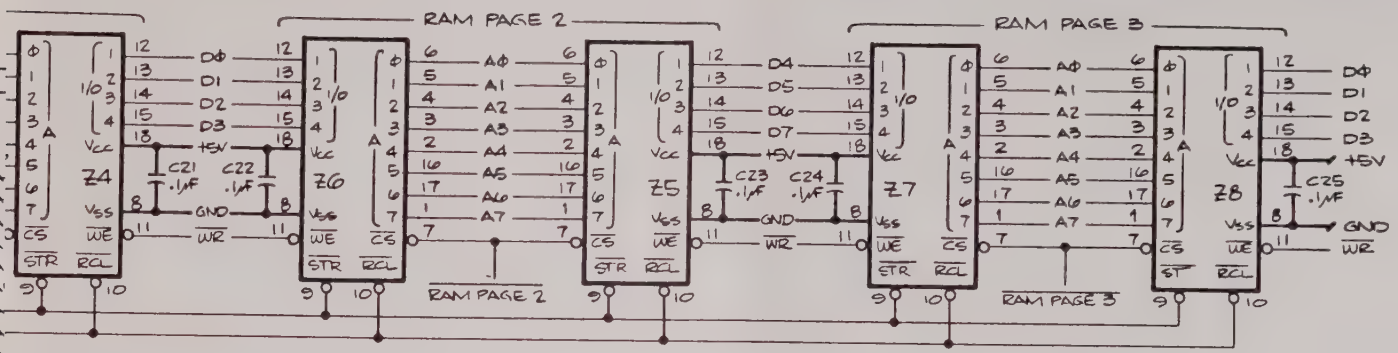
SHEET 1 OF 2

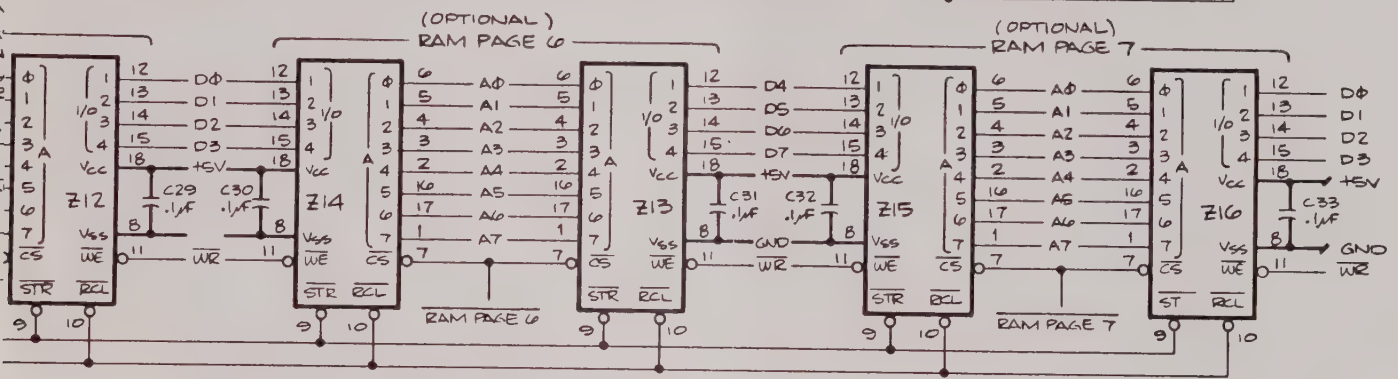


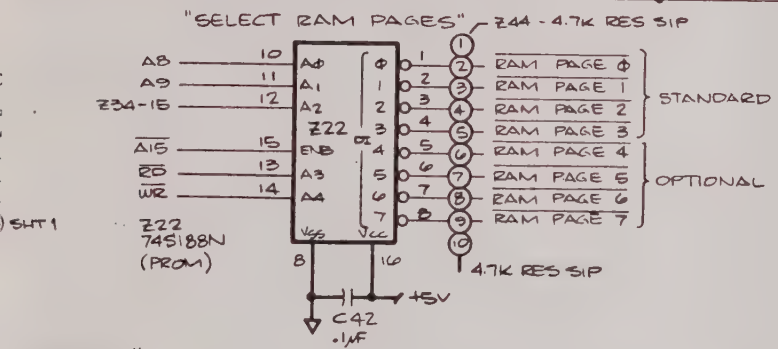
NOTES: UNLESS OTHERWISE SPECIFIED

Z1 THRU Z16 ARE 2212 (16)

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE	APPD







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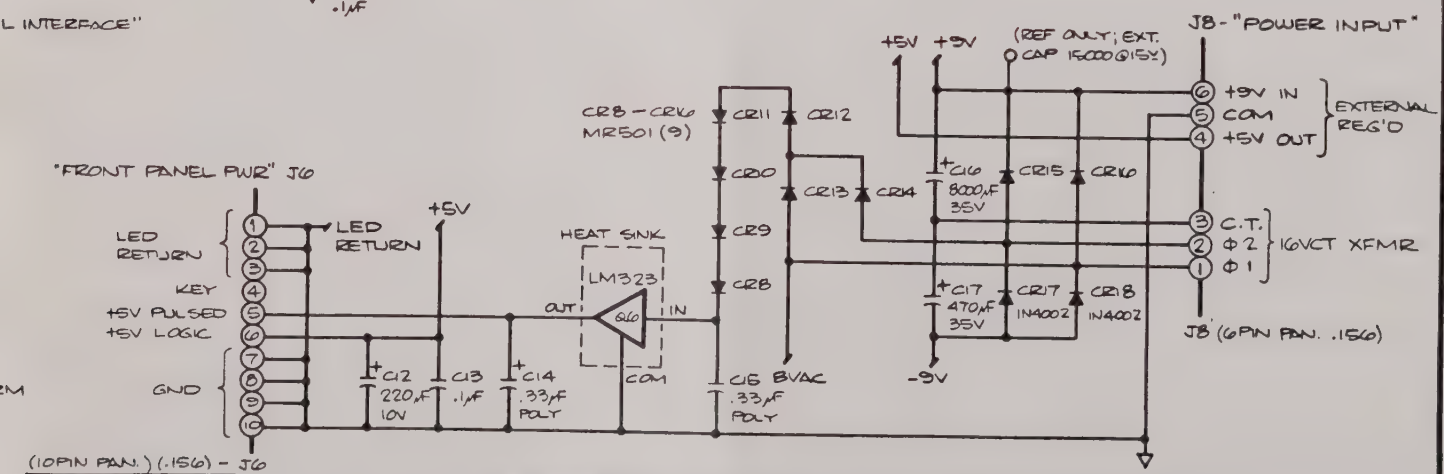


DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL						
APPLICATION				EFFECTIVITY			FINISH						

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES

DO NOT SCALE DWG

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 03 JUNE 1983
CHECKED	
APPROV	
RELEASE	

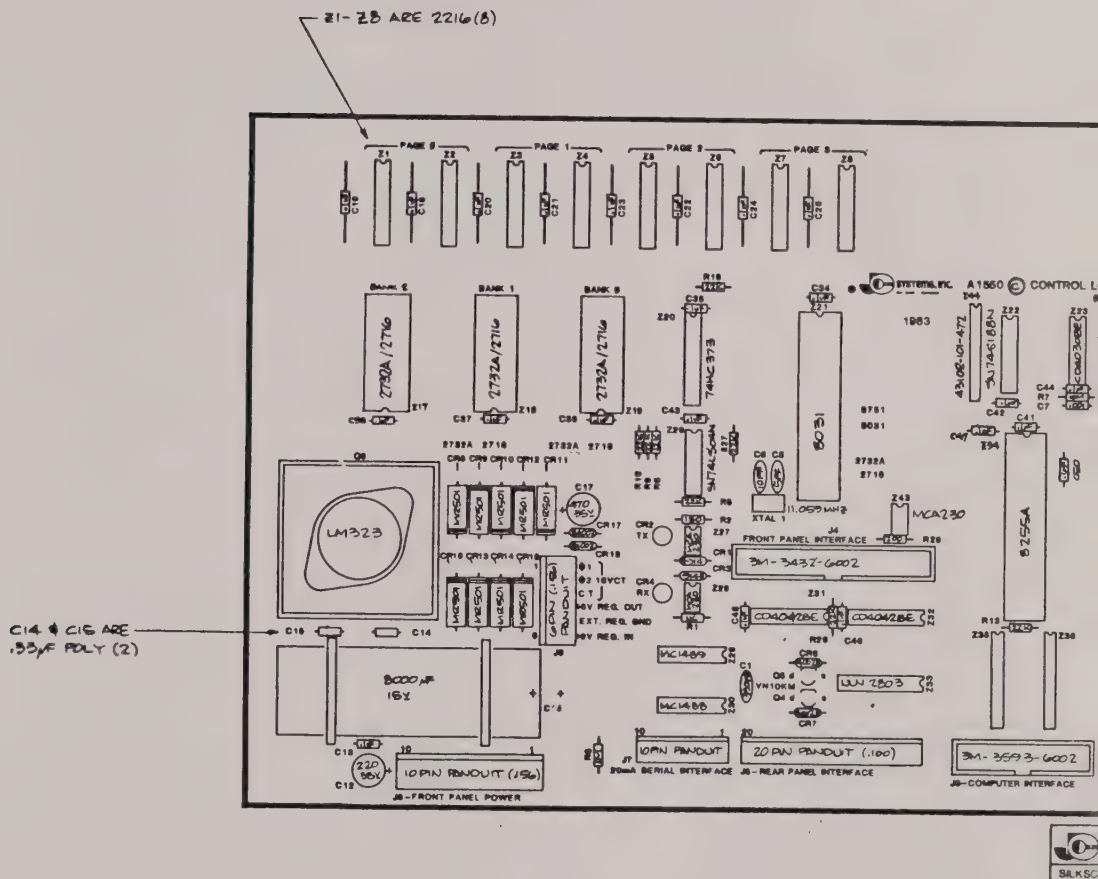
JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD. SCH- CONTROL LOGIC BD MODEL A1550

SIZE	CODE IDENT		
D		1549	C

SCALE N.A.

SHEET 2 OF 2

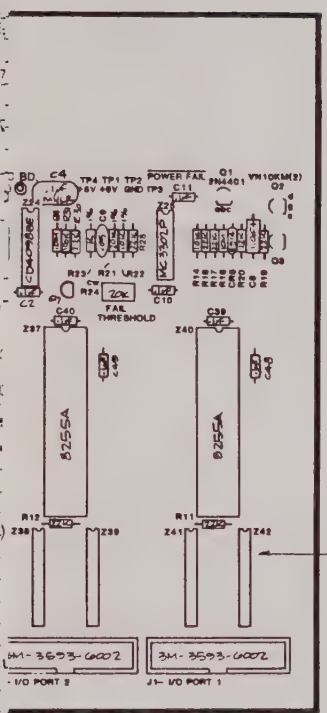


⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	REVISED PER PROTO; Z22 WAS SN74LS138; ADDED Z44 & R29; C14 & C16 WAS .1μF	7-22-83	
	B	ADDED C44 .1μF CAP	11-16-84	
	C	ADDED C47-50 (.1μF) R30, R31 & Q7 Z20 WAS 8282	3-7-85	



Z35, 36, 38, 39, 41, 42 (6)
4310R-101-223 (22K RES)

JC SYSTEMS, INC.	NO 1551	C
	DATE 4/28/83	
EN	SHT 4 OF 4	

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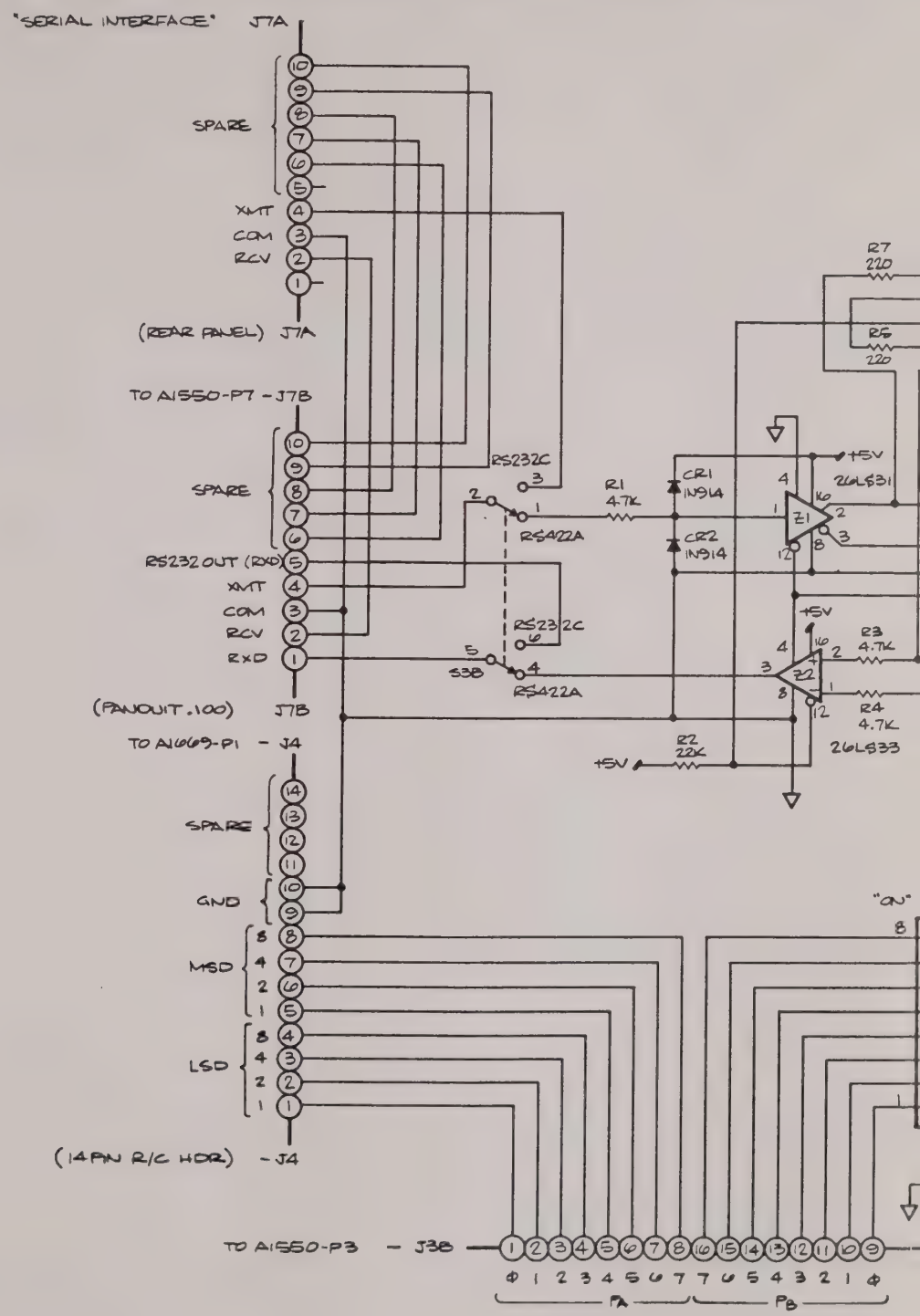
								UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES 0° 30'	ENGINEERING ACTIVITY		JC SYSTEMS, INC.
									DESIGN	JC SYSTEMS INC	TITLE: PRINTED CIRCUIT BD ASSY- CONTROL LOGIC BD. MODEL A1550
								HOLE TOLERANCES .070 THRU .250 +.004 -.001; .251 THRU .500 +.004 -.001; .250 +.002 -.000; .501 THRU .750 +.005 -.001	DRAFTED	" 27 JUNE 1983	
									CHECKED		
									APPROV		SIZE D; CODE IDENT; 1550; C
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL ⚠		RELEASE		
APPLICATION				EFFECTIVITY			FINISH ⚠		DO NOT SCALE DWG		SCALE FULL; SHEET 1 OF 1

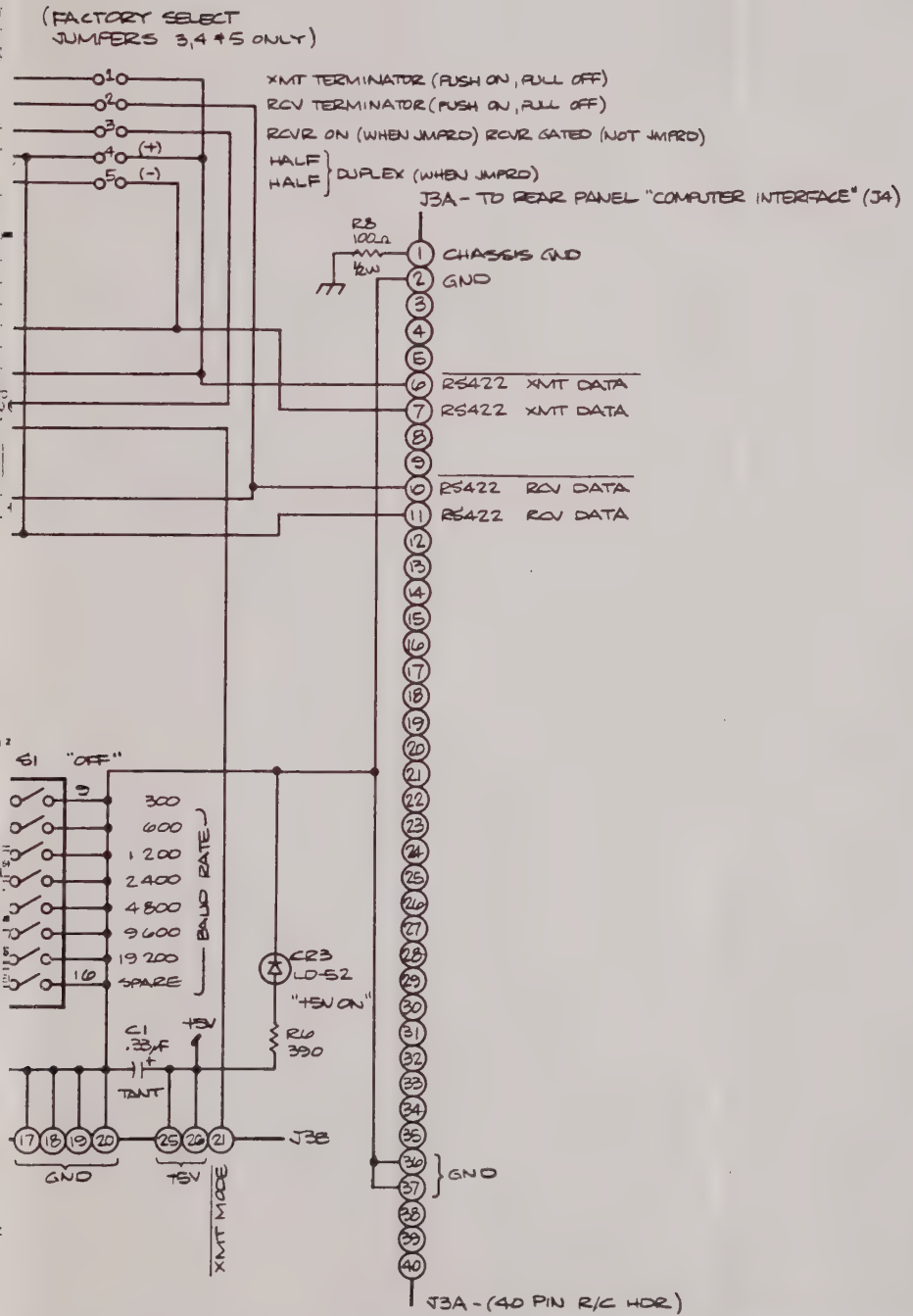


⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	J3A WAS 26 PIN; J7A WAS 4 PIN; REMOVED S2 & REWIRED OCT TO J3A	9.25.84	



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DASH QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION			EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 6' 30"
HOLE TOLERANCES
.015 THRU .125 +.004 -.001
.221 THRU .340 +.006 -.001
.726 THRU .340 +.008 -.001
.501 THRU .750 +.008 -.001
MATERIAL
FINISH

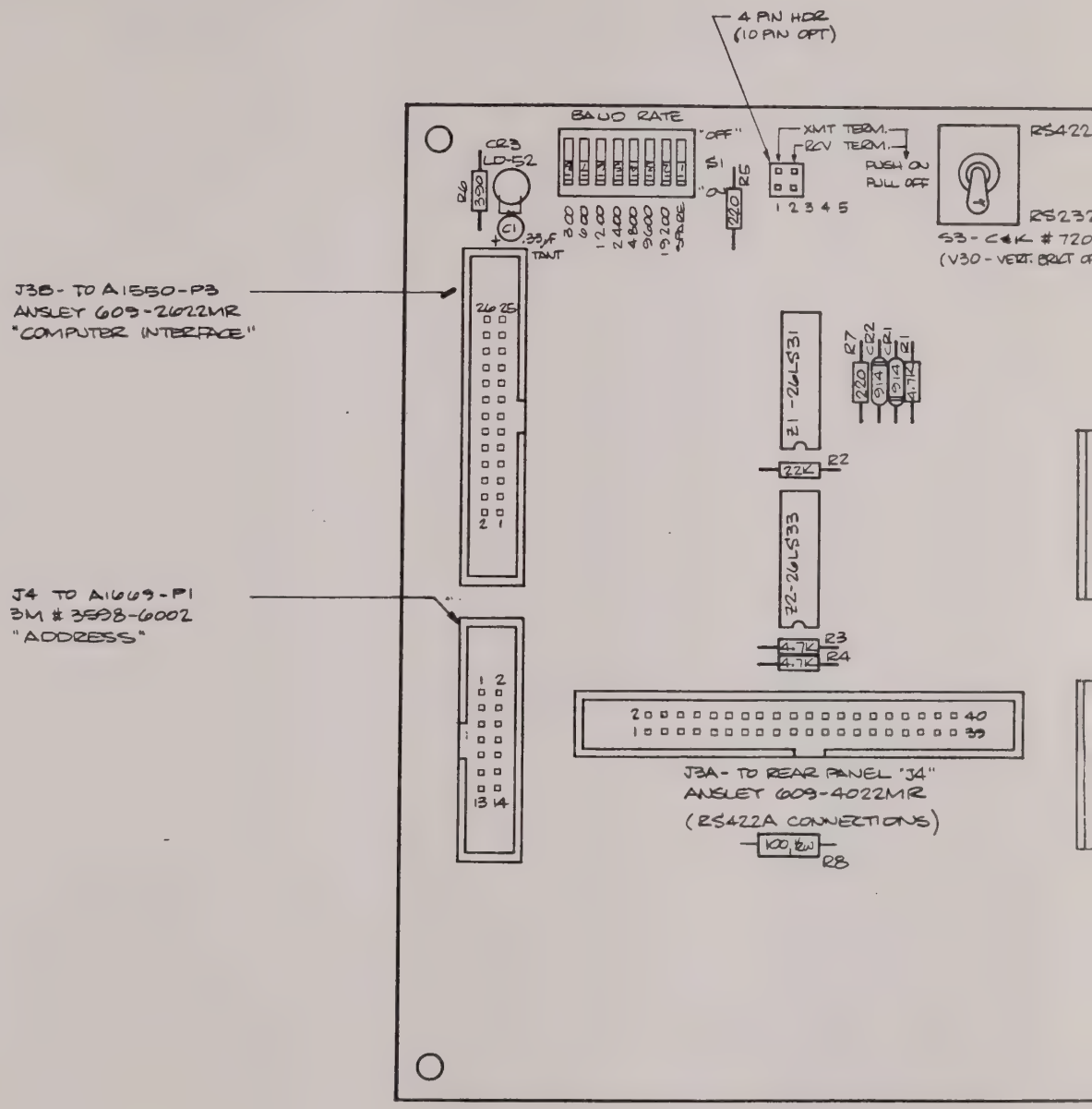
ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 22 JUNE 1984
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

JC SYSTEMS, INC. SAN DIEGO CALIFORNIA

TITLE: PRINTED CIRCUIT BD. SCH - RS422A PROGRAMMER INTERFACE MODEL A1560

SIZE	CODE IDENT		
D		1565	A

SCALE N.A. SHEET 1 OF 1



⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
		- SEE SCH 1565 -		

J7B - TO A1550-P7 (FROM "SERIAL INTERFACE" PANDUIT (.100) 10 PIN ON MAIN CONTROL LOGIC BD.)

J7A - TO REAR PANEL "J7" SERIAL INTERFACE" PANDUIT (.100) 10 PIN (RS232C CONNECTIONS)

A1550 - MAIN CONTROL LOGIC BD.

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DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03; .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES

MATERIAL
FINISH

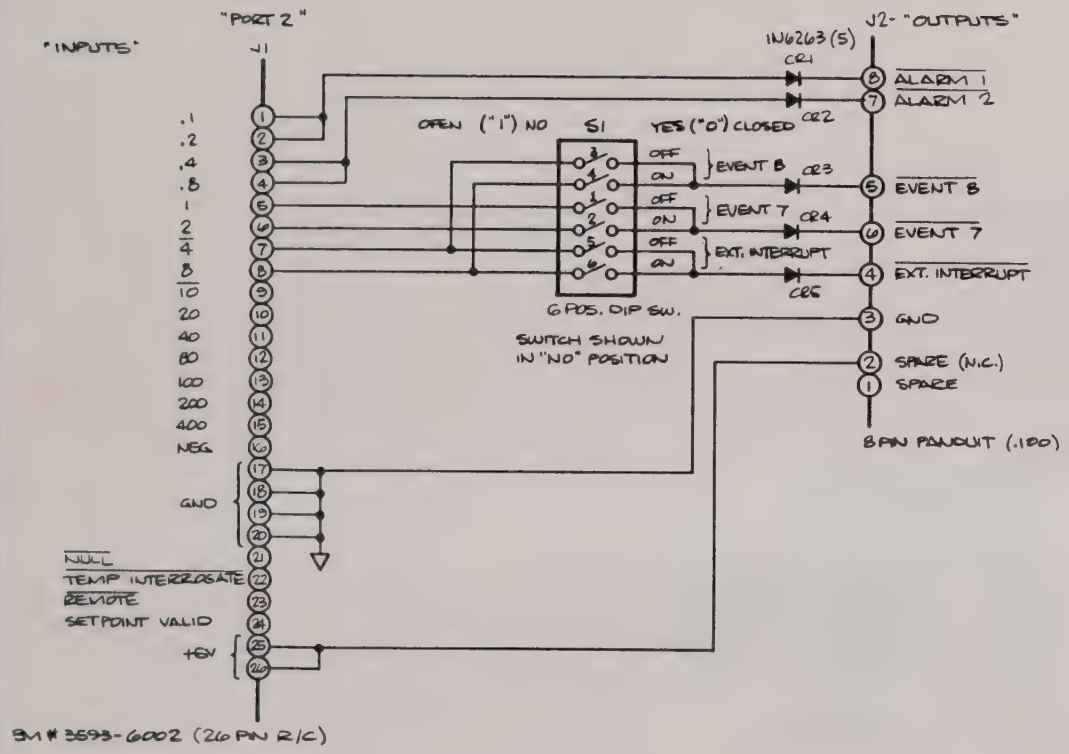
ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 22 JUNE 1984
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD. ASSY- RS422A PROGRAMMER INTERFACE MODEL A1566O

SIZE	CODE IDENT		
D		15660	A
SCALE 2:1			SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ADDED CR1-CR5 (IN6263) TO J3-4,5,6,7,8	12-7-84	



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DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03; .XXX ± .010
ANGLES: 0°30'

HOLE TOLERANCES

.013 THRU .123	+.004 −.001	.251 THRU .500	+.006 −.001
.126 THRU .250	+.006 −.001	.501 THRU .750	+.008 −.001

MATERIAL ⚠1
FINISH ⚠2

⚠1 FINISH (IF APPLICABLE)
⚠2 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	12 SEPT 1983
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

JC SYSTEMS, INC.

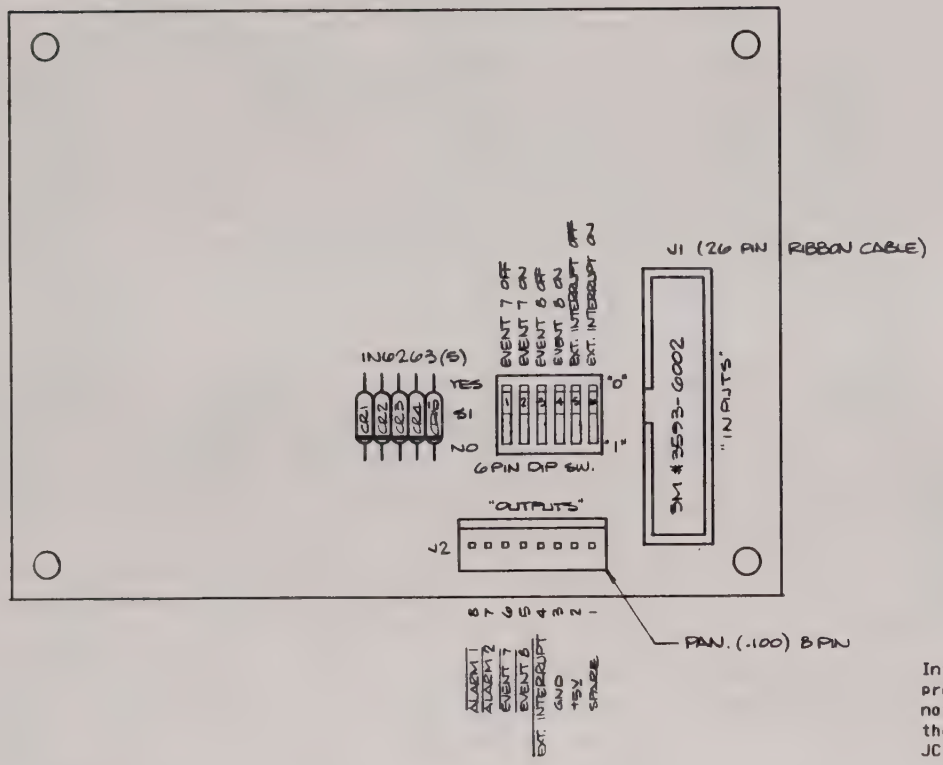
TITLE: PRINTED CIRCUIT BD. SCH— ERR INTERCONNECT MODEL A1593

SIZE	CODE IDENT		
C		1592	A

SCALE N.A.

SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
		SEE SCH 1592		



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DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'

HOLE TOLERANCES

.013 THRU .125 +.004 −.001	.201 THRU .500 +.006 −.001
.126 THRU .200 +.005 −.001	.501 THRU .700 +.008 −.001

MATERIAL ⚠
FINISH ⚠

DO NOT SCALE DWG

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 12 SEPT 1983
CHECKED	
APPROV	
RELEASE	

JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD ASSY — SRQ INTERCONNECT MODEL A1593

SIZE	CODE IDENT		
C		1593	A

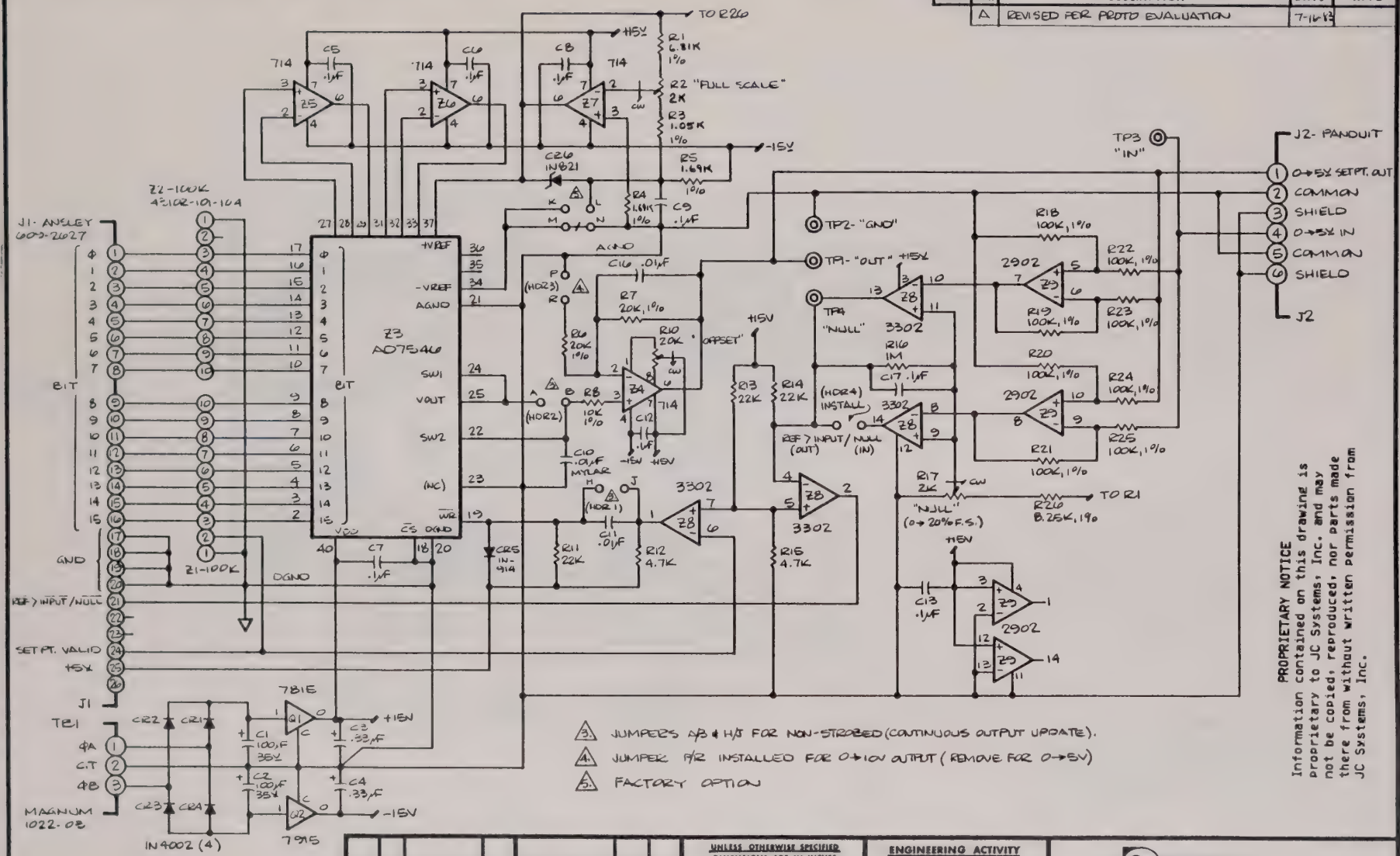
SCALE 2:1 SHEET 1 OF 1

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	REVISED PER PROTO EVALUATION	7-16-83	



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DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03, .XXX ± .010
ANGLES 0°30'
HOLE TOLERANCES
.013 THRU .332 ± .004 −.001
.333 THRU .500 ± .006 −.001
.501 THRU .750 ± .008 −.001

MATERIAL 3
FINISH 4

DO NOT SCALE DWG

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 02/09/84
CHECKED	
APPROV	
RELEASE	

JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD. SCH— 16 BIT UNIPOLAR D/A CONVERTER MODEL A1623

SIZE	CODE IDENT		
C		1622	A

SCALE N.A. SHEET 1 OF 1

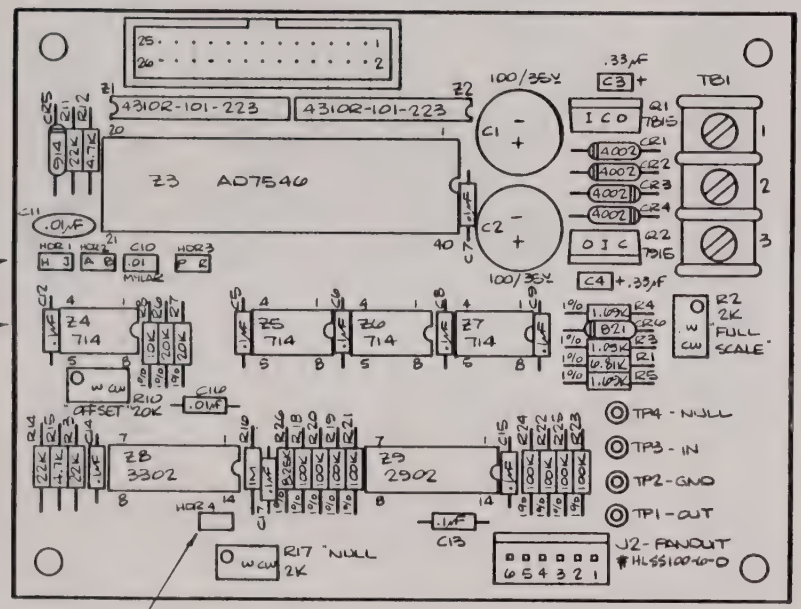
3 FINISH (IF APPLICABLE)

4 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	REVISED PER PROTO EVALUATION	7/6/84	

J1- ANSLET 609-2627



MAGNUM 1022-03-07

ΦA
C.T. } PWR INPUT
ΦB

HDR 1, HDR2, HDR3, HDR4 ARE 2 PIN HEADERS

NO SOCKETS FOR Z4, Z5, Z6 & Z7 (4)

(INSTALL JUMPER)
JUMPER : INSTALLED = NULL
NOT- " " = REF > INPUT

SHIELD
COMMON
0→5V TEMP
SHIELD
COMMON
0→5V REF. OUT

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DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0°30'

HOLE TOLERANCES

.015 THRU .128 +.004 −.001	.251 THRU .500 +.006 −.001
.256 THRU .390 +.005 −.001	.501 THRU .700 +.008 −.001

MATERIAL ⚠
FINISH ⚠

DO NOT SCALE DWG

ENGINEERING ACTIVITY		
DESIGN	JC SYSTEMS INC	
DRAFTED	" 02/03/84	
CHECKED		
APPROV		
RELEASE		

JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD ASSY- 10 BIT UNIPOLAR D/A CONVERTER MODEL A1623

SIZE	CODE IDENT		
C		1623	A

SCALE 2:1 SHEET 1 OF 1

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

INDEX

INDEX

NOTES: 1. Index entries in ALL CAPITALS with page numbers in **boldface** indicate a major (first-order) heading.
2. Index entries in ALL CAPITALS indicate a second-order heading.
3. Index entries in Initial Capitals indicate a third-order heading.

A
ALARM AUTO RESET, 2-11
Analog Setpoint Output, 1-10

B
BENCH MOUNTING, 2-1

C
CHANNEL 1 NULL BAND, 2-11
CHANNEL 2 NULL BAND, 2-11
Computer Access -- OPERATE-RUN Mode, 3-15
Computer Interface, 1-9
COMPUTER INTERFACING, **1-4**
CONTROL LOGIC BOARD, 1-9

D
DIGITAL CONTROLLER INTERFACES, 2-1
DIGITAL/ANALOG CONVERTER CALIBRATION, **4-1**
DIRECT PROGRAMMER OPERATION, 3-14

E
ELECTRIC CONNECTIONS AND INTERFACING, **2-1**
End Program, 3-12
End-of-Program Step, Importance of, 3-12
Enter Channel 1 Alarm Limits, 3-10
Enter Channel 1 Setpoint, 3-10
Enter Channel 2 Alarm Limits, 3-11
Enter Channel 2 Setpoint, 3-11
Enter Parameters for Remaining Steps, 3-11
Enter Selected Events, 3-11
Enter Time (Segment Duration), 3-11
ENTERING A PROGRAM, 3-9
External Control Inputs, 3-15
EXTERNAL CONTROL SIGNALS, 2-5
EXTERNAL OPERATION, 3-15

F
First Segment Special Features, 3-9
FRONT PANEL, 1-5
Front Panel Display Board, 1-5
FRONT PANEL SWITCH AND DISPLAY TEST, 4-2
Front Panel Switch Board, 1-5

G
General Instructions, 3-9

I
IEEE-488 COMPUTER INTERFACE, 2-6
IEEE-488 INTERFACE OPTION, 1-4
IEEE-488 SERVICE REQUEST FUNCTION, 2-9
Importance of End-of-Program Step, 3-12

L
LOCAL/SETPOINT HOLD, 2-11

M
MOUNTING, 2-1

O
OPERATE-RUN Mode, 3-14
OPERATE-RUN., 1-3
OPERATE-STOP Mode, 3-14
OPERATE-STOP., 1-4
OPERATION, 3-14
OPTIONAL BOARDS, 1-9

P
PARAMETERS STORED, 1-2
POWER-UP AND THRESHOLD TEST, 4-2
PRINCIPAL COMPONENTS, 1-5
PROFILE WORKSHEET, -1
Program Length, 3-12
PROGRAM REVIEW/DISPLAY, 1-3
PROGRAM, 1-4
PROGRAMMER FEATURES, 1-1
Programmer Memory Capacity, 3-12
PROGRAMMER TEST PROCEDURE, 4-2
PROGRAMMING, 3-9

R
RACK MOUNTING, 2-1
REAR PANEL, 1-9
REMOTE COMPUTER ACTIVE Mode, 3-17
RS-232 COMMUNICATIONS INTERFACE, 2-6
RS-232/RS-422 INTERFACE, 2-6
RS-232/RS-422 Interface Switch Settings, 2-8
RS-232/RS-422 PARALLEL COMMUNICATIONS OPTION, 1-5
RUN DURING DEVIATION, 2-12

S
SCALING, 3-13
Select Starting Step, 3-10
SERIAL INTERFACE OPTION, 1-5
Service Request (Serial Poll) Data, 2-10
Service Request DIP Switch Settings, 2-9
Service Request Enable/Disable, 2-9
Special First Segment Features, 3-9
SPECIFICATIONS AND REFERENCE DATA, 1-10
STANDARD RS-232 INTERFACE, 1-4
STORING MULTIPLE PROGRAMS, 3-12
SWITCH-SELECTABLE FEATURES (Setting of), 2-10
SWITCH-SELECTABLE FEATURES (List of), 1-2
SWITCHES AND DISPLAYS, 3-1

T
TIME SCALE SETTING, 2-11

U
UNPACKING, **2-1**

V
Voltage Connections, 2-6

W
WINDOW 1 - CHANNEL 1 GUARANTEED SOAK, 2-10
WINDOW 2 - CHANNEL 2 GUARANTEED SOAK, 2-11
WORKSHEET, PROFILE, **A-1**

100533